INTERNATIONAL EMERGENCY MEDICINE EDUCATION PROJECT

iEM for Medical Students and Interns

EMERGENCY MEDICINE CLERKSHIP

100 Multiple Choice Questions

Author
Joseph **Ciano**

Editor
Arif Alper **Cevik**

2023

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Currently, the project boasts 229 contributors from 41 countries, and majority of the original images used in this book were provided by these contributors. The iEM Education Project would like to extend its sincere gratitude to all of its contributors for their continued support of this non-profit, global education initiative.

Content

Questions	Comments	Page
1-10	The initial set of 10 questions included in this book covers a range of diverse topics, from symptoms such as chest pain, syncope, altered mental status, and headache, to various problems related to the cardiovascular system, central nervous system, endocrine system, trauma, shock, and poisoning. These questions are designed to challenge your knowledge and clinical reasoning abilities across a broad spectrum of emergency medicine scenarios, providing an excellent foundation for the subsequent questions and explanations.	11-23
11-20	These questions focus on the complaint of **chest pain**, exploring various potential underlying conditions such as acute coronary syndromes and pulmonary embolism.	25-39
21-30	These questions focus on **cardiac arrest and arrhythmia**, commonly encountered in emergency department patients.	40-56
31-40	These questions aim to explore the common causes of **abdominal pain** complaints and cover a wide range of problems related to gastrointestinal and genitourinary diseases.	57-73
41-50	These questions are designed to test your knowledge and decision-making skills in cases of **altered mental status**. The cases presented cover a wide range of conditions, including those related to the endocrine system, central nervous system, and poisoning, among others.	75-90
51-60	These questions focus on patients with **shock**, covering various etiologies such as septic, cardiogenic, hypovolemic, and obstructive.	91-106
61-70	The questions in this section pertain to **trauma** patients and cover various aspects related to trauma.	107-121
71-80	These questions cover a range of toxidromes and **poisoning**-related issues commonly encountered in emergency department patients. From drug overdoses to exposure to toxins and chemicals, these questions provide scenarios to help you build your knowledge and skills in the management of poisoned patients.	122-136
81-90	This set of questions covers various clinical scenarios related to **shortness of breath**, a common chief complaint in the emergency department. These scenarios encompass a range of underlying conditions, including but not limited to respiratory diseases, cardiac diseases, and pulmonary embolism, providing a comprehensive approach to understanding and managing patients with this symptom.	137-152
91-100	These questions are designed to test your knowledge on various problems related to **gastrointestinal bleeding** in patients who present to the emergency department.	153-166
Question Information	The table covers complaints in question and domains (e.g. diagnosis, therapy) and cognitive levels (e.g. analysis, comprehension).	168-171

Foreword

The landscape of emergency medicine clerkships varies greatly from country to country. While some nations have well-designed undergraduate emergency medicine education programs in their medical schools, many lack guidelines, curriculum, and sufficient resources such as faculty members and educational materials. Even in developed countries, undergraduate emergency medicine education recommendations are often poorly supported by limited resources, such as textbooks and websites, for medical students and interns.

This book was created to provide clinical decision-making, critical thinking, and clinical reasoning clues for commonly seen medical problems related to emergency medicine, all through multiple-choice questions and explanations. The countless hours of hard work put in by all contributors have resulted in a valuable addition to emergency medicine resources for medical students and interns. Nevertheless, we recognize that there are still areas in which this book, as well as other resources, can be improved upon.

Our ultimate goal is to ensure that emergency medicine resources for medical students and undergraduate emergency medicine training meet the minimum required standards in all countries. This will require the endless collaboration of emergency medicine professionals, education enthusiasts, and students. We remain committed to this process, and we look forward to making continued progress towards this shared goal.

Prof Arif Alper Cevik
Founder and Director, The International Emergency Medicine Education Project
Faculty, Tawam Hospital, Emergency Medicine Residency Program
Faculty, Department of Internal Medicine
United Arab Emirates University, College of Medicine and Health Sciences
Al Ain, 15551, UAE

Editor

Arif Alper Cevik, MD, FEMAT, FIFEM

Prof Cevik is an Emergency Medicine academician at United Arab Emirates University, interested in international emergency medicine, emergency medicine education, medical education, point of care ultrasound and trauma. He is the founder and director of the International Emergency Medicine Education Project – iem-student.org, vice-chair of the International Federation for Emergency Medicine (IFEM) core curriculum and education committee and board member of the Asian Society for Emergency Medicine and Emirati Board of Emergency Medicine.

Preface

This book contains multiple-choice questions written in the form of clinical vignettes. These questions aim to cover high-yield topics in Emergency Medicine, but the content covered is far from encompassing everything you need to know in this unique and exciting field. The goal of these questions is to both teach and review high-yield concepts but more to inspire you to read more on the topics reviewed. Learning resources for further review are provided after each question. As you complete this book, I challenge you to understand why the correct choice is correct, and perhaps more importantly, try to understand why the incorrect choices are incorrect. This will maximize your learning from each question. Good luck on your journey, and enjoy.

Best,

Joey Ciano, DO, MPH, MS
Emergency Medicine Physician
Northwell-LIJ Medical Center
Department of Emergency Medicine
270-05 76th Ave, Queens, NY 11004

Author

Joseph Ciano, DO, MPH, MS

Dr Ciano is an Emergency Medicine Physician from New York, USA. He completed his Emergency Medicine Residency in Brooklyn, NY and a Fellowship in Global Emergency Medicine in the Northwell-LIJ Health System. He is interested in building the educational infrastructure of EM in countries where Emergency Medicine is not yet recognized as a field and in countries that are in the early stages of this process. He has partnered with international NGOs in Emergency Medicine educational projects and works as a visiting Emergency Medicine faculty member in West Bengal, India. He is excited to collaborate with the other authors of the iEM Education Project to contribute to the world of FOAM-ed.

How To Use This Book

Welcome to 100 Emergency Medicine MCQs! This book contains 100 multiple-choice questions that cover commonly seen clinical problems in the emergency department.

Each question is presented in a group of 10 and includes a case vignette, image, or laboratory results (if applicable), a lead-in (question), and four answer options. Before answering each question, carefully review the provided information and connect it to the lead-in. Once you have chosen your answer, you can immediately proceed to the detailed explanation of each question.

While medical knowledge is crucial, it's equally important to apply that knowledge in challenging and time-sensitive scenarios. This book is designed to help you develop your clinical decision-making, clinical reasoning, and critical thinking skills. By understanding how emergency physicians approach these situations, you will be better equipped to do the same.

Dr. Joseph Ciano, the author, has provided detailed explanations for each question, offering valuable insights into the thought process of emergency physicians. We hope you find this book both educational and enjoyable, and that it contributes to your success as a medical professional.

Question 1

A 68-year-old man presents to the Emergency Department complaining of acute onset central chest and midline back pain while watching television 2 hours prior to arrival. The pain has been constant, non-exertional, sharp, and worsening since onset. He is a long-time tobacco smoker but has no known medical history. He has not seen a medical doctor in over 30 years. On examination, his temperature is 37°C, blood pressure 210/100 mmHg, pulse 105 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The patient is diaphoretic and appears uncomfortable. A bedside 12-lead EKG shows sinus tachycardia. A diagnosis is made after a CT angiogram of the chest is performed.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Unfractionated Heparin drip

B. 20 mg of IV Labetalol

C. 324 mg of Aspirin

D. Cardiology consultation

Question 2

A 81-year-old man presents to the Emergency Department after an unwitnessed syncopal episode at home. The patient states he was walking to the bathroom and "woke up" on the ground. He denies having any chest pain, nausea, sweating, shortness of breath, or other symptoms prior to the event. He is currently asymptomatic. His medical history includes hypertension, diabetes, congestive heart failure, and hyperlipidemia. On examination, his temperature is 37°C, blood pressure 150/90 mmHg, pulse 82 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 96% on room air. While examining the patient, he becomes unresponsive and pulseless in bed. The bedside monitor shows the below cardiac rhythm.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Synchronized Cardioversion

B. Asynchronized Cardioversion

C. Transcutaneous Pacing

D. Intravenous Fluids

Question 3

A 79-year-old woman from a Nursing Home facility presents to the Emergency Department with altered mental status for seven days. Staff at the patient's facility say that the patient has had poor oral intake for weeks and has become increasingly somnolent. The patient has a medical history of coronary artery disease, severe Alzheimer's dementia, hypertension, and diabetes. On examination, her temperature is 37°C, blood pressure 100/60 mmHg, pulse 106 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 95% on room air. Bedside point-of-care glucose is within normal limits. She is somnolent on physical examination, unable to follow commands, has dry oral mucosa, and responds to painful stimuli in all extremities. The patient has a generalized tonic-clonic seizure for one minute, which self-resolves. Laboratory test results are below.

Test	Test Result	Reference Range
Glucose, serum	67	65-99 mg/dL
BUN	38	5-26 mg/dL
Creatinine	2.1	0.76-1.27 mg/dL
Sodium, serum	108	135-145 mmol/L
Potassium, serum	3.6	3.5-5.0 mmol/L
Chloride, serum	98	97-108 mmol/L

Which of the following is the most appropriate next step in management for this patient's condition?

A IV 1,000 mL of 0.9% NaCl

B IV 50 mL of 25 g dextrose solution

C IV 250 mL of 3% NaCl

D IV 40 mg Furosemide

Question 4

A 35-year-old woman presents to the Emergency Department complaining of severe left-sided headache and nausea that began abruptly 5 hours prior to arrival. She denies any trauma, syncope, or fevers. She has a medical history of migraines but states that this headache feels different from her typical migraine headaches. On examination, her temperature is 37°C, blood pressure 160/90 mmHg, pulse 103 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air.

Which of the following is the most appropriate next step in management for this patient's condition?

A Lumbar Puncture

B IV 1000 mL 0.9% NaCl

C IV Ceftriaxone

D Non-contrast CT head

Question 5

A 24-year-old man presents to the Emergency department complaining of abdominal pain after a motor vehicle accident. The patient was the front passenger, he was wearing a seatbelt, and he recalls airbag deployment. On examination, his temperature is 37°C, blood pressure 88/60 mmHg, pulse 125 beats/min, 22 respiratory rate breaths/min, and oxygen saturation is 99% on room air. In addition, you note a linear area of ecchymoses across the patient's abdomen. The image below is from the FAST (Focused Assessment with Sonography in Trauma) exam performed on this patient.

Which of the following is the most appropriate next step in management for this patient's condition?

A. CT scan of abdomen and pelvis

B. Exploratory laparotomy

C. Diagnostic Peritoneal Lavage (DPL)

D. Emergent thoracotomy

Question 6

A 82-year-old woman presents to the Emergency Department with altered mental status and fever for two days. The family of the patient state that she has unintentionally lost 20 pounds (9 kg) over the last three months, and her skin has taken on a yellowish appearance. Earlier this week, they noted she was complaining of upper abdominal pain. The patient's past medical history includes hypertension. She has no past surgical history. On examination, her temperature is 38.5°C, blood pressure 90/40 mmHg, pulse 122 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The patient is obtunded on physical examination with obvious jaundice, a distended abdomen, and warm distal extremities. Selected laboratory tests are provided below.

Test	Test Result	Reference Range
Glucose, serum	102	65-99 mg/dL
White blood cell count	22.5	4.0-11.0 x 10^3/µl
Hemoglobin	11.4	12.0-16.0 g/dL
AST	321	8-20 U/L
ALT	563	8-20 U/L
Total bilirubin	6.2	0.1-1.0 mg/dL

Which of the following is the most likely cause of this patient's condition?

A. Cardiogenic shock
B. Obstructive shock
C. Distributive shock
D. Hypovolemic shock

Question 7

A 66-year-old woman presents to the Emergency Department complaining of cough, fever, and generalized weakness for one week. She is a long-time tobacco smoker with frequent prior diagnoses of community-acquired pneumonia. On examination, her temperature is 39°C, blood pressure 80/40 mmHg, pulse 120 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 89% on room air. The patient is given supplemental oxygen via a non-rebreather mask, increasing the oxygen saturation to 95%. A chest X-ray shows right middle lobar pneumonia. The patient is given IV antibiotics and an appropriate bolus of crystalloid fluids for her body weight. Her repeat vital signs include a blood pressure of 86/42 mmHg (MAP 57 mmHg) and a heart rate of 110 beats/min.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Endotracheal intubation
B. IV Fluids
C. IV vasopressors
D. Acetaminophen

Question 8

A 23-year-old man presents to the Emergency Department with altered mental status and agitation since this evening. He was last seen at home by his parents earlier in the day. The parents note that his girlfriend recently ended their relationship, and he has been increasingly depressed lately. The patient has no medical history and takes no medications regularly, although he has used recreational drugs in the past. On examination, his temperature is 39°C, blood pressure 170/100 mmHg, pulse 135 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. Bedside glucose testing is normal. The patient is agitated with rapid speech and has mydriatic pupils, dry axilla, and dry oral mucosa. A 12-lead EKG shows sinus tachycardia with a QRS interval of less than 120 msec.

Which of the following is the most likely cause of this patient's condition?

A. Amitriptyline
B. Cocaine
C. Physostigmine
D. Diphenhydramine

Question 9

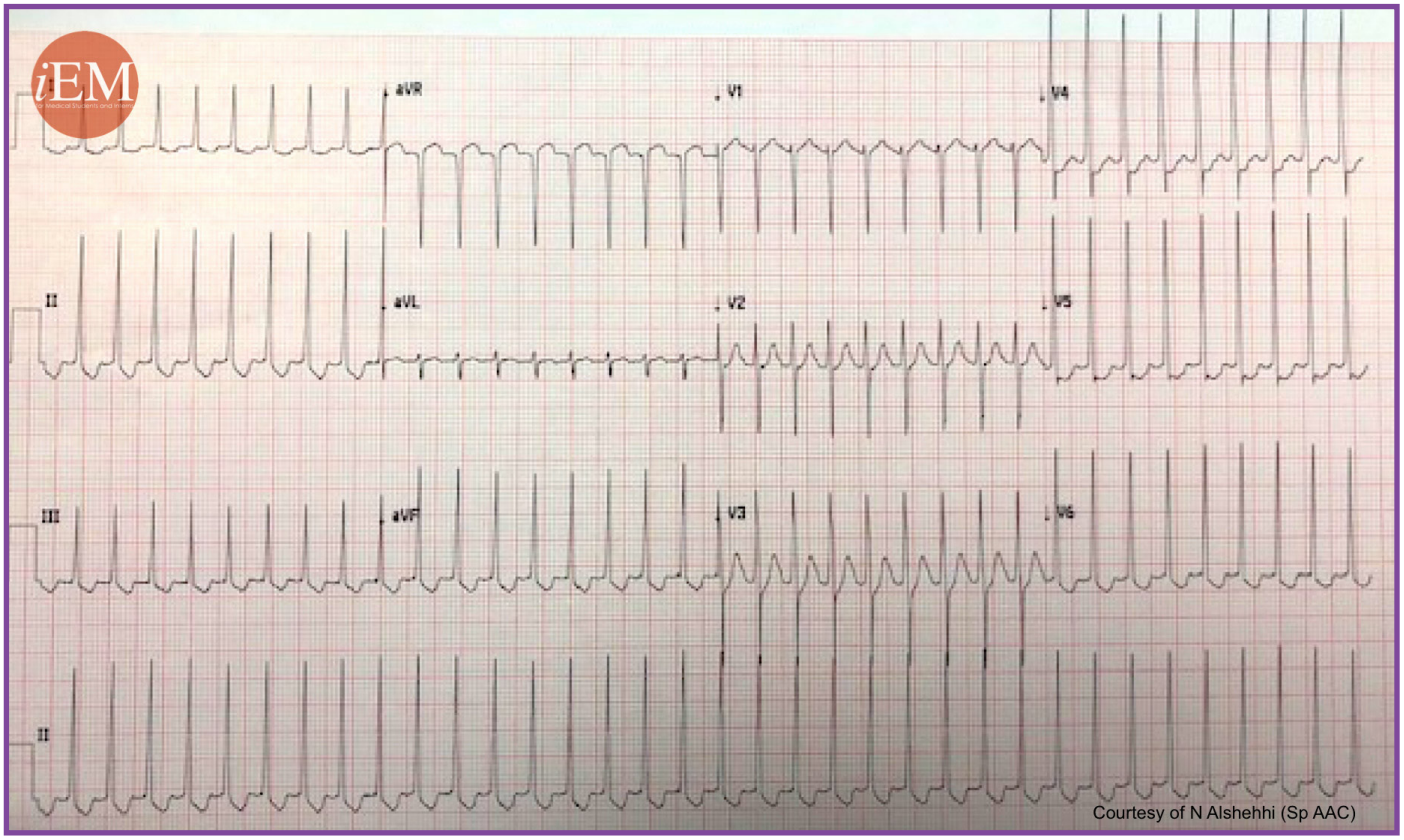
A 32-year-old man presents to the Emergency Department with agitated delirium. He is brought by ambulance and is unable to provide additional history given his clinical condition. The patient has a past medical history of depression and polysubstance abuse. On examination, his temperature is 39°C, blood pressure 180/105mmHg, pulse 136 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air. Bedside glucose testing is normal. He is pacing frantically around the Emergency Department, diaphoretic, and has mydriatic pupils on physical examination. A 12-lead EKG shows sinus tachycardia with a QRS interval of 100 msec.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Sodium bicarbonate
B. Diazepam
C. Physostigmine
D. Naloxone

Question 10

A 23-year-old woman presents to the Emergency Department complaining of acute onset palpitations and anxiety while studying for her school final exams. She denies chest pain, syncope, diaphoresis, or prior similar episodes. She admits to drinking 8 cups of coffee per day to help her study late at night. On examination, her temperature is 37°C, blood pressure 105/70 mmHg, pulse 180 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 100% on room air. A 12-lead EKG is shown below.



Courtesy of N Alshehhi (Sp AAC)

Which of the following is the most appropriate next step in management for this patient's condition?

A IV Adenosine 6 mg

B Synchronized cardioversion

C IV Amiodarone 150 mg

D Vagal maneuvers

Explanation – Question 1

The patient in this scenario has an aortic dissection until proven otherwise. Administering anticoagulation (Choice A: Unfractionated Heparin Drip) would be the correct treatment for a pulmonary embolism. Although the patient has mild tachycardia and tachypnea on physical exam, characteristics of the history and physical exam point closer to a diagnosis of aortic dissection.

Features of the history that support a diagnosis of aortic dissection include pain described as "tearing", "ripping", or pain radiating to the back. Other characteristics include unequal blood pressure in the extremities or neurological symptoms.

Aortic dissections that migrate proximally may cause cardiac tamponade or a STEMI if they involve the coronary arteries. Choice C (Aspirin) would be the treatment for Acute Coronary Syndrome. Choice D (Call a Cardiology consultation) would not be appropriate for a patient with aortic dissection. A cardiothoracic surgical consultation would be appropriate in a patient with an aortic dissection involving the ascending aorta (Type A aortic dissection). Aortic dissections distal to the left subclavian artery that involve the descending aorta (Type B aortic dissection) are typically managed medically with blood pressure control.

Choice B (IV Labetalol) is the correct answer, as Aortic Dissections require aggressive blood pressure control with a goal of less than 120/80 mmHg. Beta-blockers like Labetalol are considered first-line therapy as they provide alpha and beta-adrenergic receptor blockade. This allows the reduction of blood pressure without a reflex tachycardia response. Esmolol is an alternative therapy. Beta-blockers decrease vessel shearing forces that could worsen the intimal tearing of the vessel. If beta-blockers alone cannot control blood pressure sufficiently, other medications like nicardipine, nitroglycerin, or nitroprusside can be included in the treatment regimen.

Reference

- Johnson GA, Prince LA. "Chapter 59: Aortic Dissection and Related Aortic Syndromes". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.

Explanation – Question 2

The patient in this scenario has decompensated into cardiac arrest from Ventricular Tachycardia (Vtach). The patient's history of heart failure puts him at risk for cardiac arrhythmias. It is important to be suspicious of transient cardiac dysrhythmias for any patients who present to the Emergency Department with syncope and no prodromal symptoms. A lack of prodromal symptoms (i.e. diaphoresis, dizziness, nausea) before syncope should raise concern for a possible cardiac etiology.

Choice A (Synchronized Cardioversion) would be the correct management for patients with Vtach with a pulse or patients with tachyarrhythmias and hemodynamic instability (i.e. hypotension). Choice C (Transcutaneous Pacing) would be the correct management for patients with bradyarrhythmia and hemodynamic instability. In these patients, if Transcutaneous Pacing is ineffective at increasing the heart rate and the patient remains hemodynamically unstable, the next step would be Transvenous Pacing. Choice D (Intravenous Fluids) may be helpful in a patient with cardiac arrest with Pulseless Electrical Activity or Asystole, but this is not the best initial action. The ACLS algorithm indicates that all patients with cardiac arrest due to Pulseless Ventricular Tachycardia or Ventricular Fibrillation

should receive Asynchronized Cardioversion/Defibrillation **(Choice B)**. CPR may be initiated prior to Asynchronized Cardioversion/Defibrillation if defibrillation pads are not attached to the patient.

Reference

- Long B, Koyfman A, Anantharaman V, Lim S, Ong MH, Kenneth T, Manning JE. "Chapter 24: Cardiac Resuscitation". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9thed.

Explanation – Question 3

Choice A (IV 1,000mL of 0.9% NaCl) is an isotonic crystalloid fluid helpful in a patient with depleted intravascular volume (i.e. dehydration). This patient is clinically dehydrated (dry oral mucosa and mild tachycardia); however, hypertonic 3% NaCl is a more appropriate initial treatment. Choice B (IV 50mL of 25g dextrose solution, commonly known as "D50") is an appropriate treatment for a patient with hypoglycemia. Checking a glucose level is a crucial part of the initial assessment of all patients with altered mental status, but this patient has a reported normal glucose level. Choice D (IV 40mg Furosemide) is a diuretic that worsens this patient's dehydration and acute kidney injury.

This patient has severe hyponatremia along with neurological symptoms (coma and seizure). Hyponatremia plus neurologic symptoms, like vomiting, seizures, reduced consciousness, and cardiorespiratory arrest, necessitate **rapid correction of sodium levels with hypertonic (3%) NaCl solution (Choice C)**. 3% NaCl solution can be infused 100-150mL over 15-20min and repeated up to 3 doses total. A serum sodium level should be measured after each administration of 3% NaCl in order to limit the increase in the sodium level to no more than 8-12 mEq/L over the first 24 hours. This is done to reduce the risk of osmotic demyelination syndrome.

Reference

- Petrino R, Marino R. Fluids and Electrolytes. "Chapter 17: Fluids and Electrolytes". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.

Explanation – Question 4

This patient describes her headache as severe, sudden-onset, and different from her prior headaches. These clues in history should raise concern for a subarachnoid hemorrhage (SAH) as the cause of her headache.

Choice A (Lumbar Puncture) is helpful in evaluating headaches caused by meningitis, pseudotumor cerebri (idiopathic intracranial hypertension), and SAH. Choice B (IV 1000mL 0.9% NaCl) is sometimes used to treat headaches, like migraines, but this patient should receive another test first as there is a concern for SAH.Choice C (IV Ceftriaxone) is the correct initial treatment for bacterial meningitis, but this patient has a higher pretest probability for SAH.

Choice D (Non-contrast CT head) is the correct answer. Non-contrast CT scan of the brain performed within 6 hours of headache onset have high sensitivity to rule out aneurysmal SAH. The sensitivity of the non-contrast CT scan diminishes to 91-93% at 24 hours after headache onset and continues to decrease after this to 50% sensitivity at seven days after pain onset. Lumbar puncture is recommended for a patient with a negative CT scan, high pretest probability for SAH, and presenta-

tion after 6 hours of headache onset. Findings on Lumbar Puncture that support the diagnosis of SAH include Xanthochromia, a yellow appearance of the cerebrospinal fluid (CSF) due to blood breakdown and inadequate clearing of red blood cells in the CSF between tubes 1 and 4.

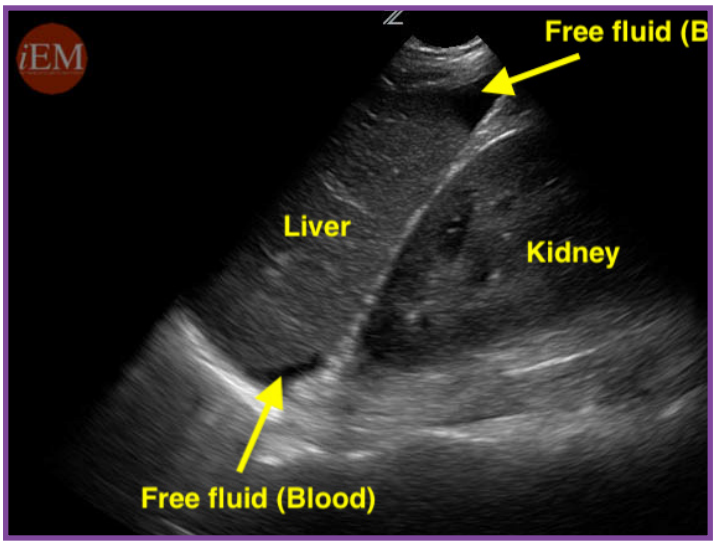
Treatment for SAH includes blood pressure control, seizure prophylaxis, and neurosurgical consultation, and nimodipine to prevent vasospasm and rebleeding. The Hunt and Hess scoring system can be used to predict clinical outcomes for patients with SAH.

Reference

- Nelson AM, Mase CA, Ma O. Spontaneous Subarachnoid and Intracerebral Hemorrhage. "Chapter 166: Spontaneous Subarachnoid and Intracerebral Hemorrhage". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.

Explanation – Question 5

This patient has sustained blunt abdominal trauma from his seat belt. This is indicated by the linear area of ecchymoses, known as a "seat belt sign". This worrisome physical exam finding should raise a concern about a severe intra-abdominal injury. All trauma patients presenting to the Emergency Department should be assessed using an organized approach, including a primary survey ("ABCs") followed by a secondary survey (more detailed physical examination). The FAST (Focused Assessment with Sonography in Trauma) examination is part of the primary survey of a trauma patient. Some sources abbreviate the primary survey in trauma as "ABCDEF", which stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam. The primary survey attempts to identify any life-threatening diagnoses that need to be addressed in a time-sensitive manner. Examples include cardiac tamponade, tension pneumothorax, and intra-abdominal bleeding.



The FAST exam includes four basic views: the right upper quadrant view (liver and right kidney), pelvis view (bladder), left upper quadrant view (spleen and left kidney), and cardiac/subxiphoid view (heart). An E-FAST, or extended FAST, includes the four standard FAST views plus bilateral views of the lungs to evaluate for pneumothorax. An abnormal FAST exam demonstrates the presence of free fluid on ultrasound. In the setting of trauma, free fluid is assumed to be blood. Free fluid on ultrasound appears black or anechoic (indicated by yellow arrows in below image).

The space between the liver and right kidney ("Morrison's Pouch") is often the first location of blood to accumulate in a patient with intra-abdominal bleeding. Trauma patients who are hemodynamically unstable with a positive FAST exam (this patient) should go to the operating room for emergent exploratory laparotomy **(Choice B)** to determine the source of their bleeding.

Performing a CT scan of the abdomen and pelvis (Choice A) would be the correct answer if the patient was hemodynamically stable and had a positive FAST exam. Allowing this patient to leave the Emergency Department for a CT scan would be dangerous as this patient could rapidly decompensate.

Performing a Diagnostic Peritoneal Lavage (Choice C) would be the correct answer if the patient was hemodynamically stable but had a normal FAST exam.

An emergent thoracotomy (Choice D) is more typically performed in patients with penetrating trauma who have cardiac arrest shortly before presenting to the Emergency Department. This intervention attempts to identify and treat any reversible causes of cardiac arrest.

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- Butler, M. (2015). "Boring question: What is the role of the FAST exam for blunt abdominal trauma?" Canadiem. https://canadiem.org/boring-question-what-is-the-role-of-the-fast-exam-for-blunt-abdominal-trauma/
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Explanation – Question 6

This patient is in septic shock due to ascending cholangitis. Shock is a condition where the body is unable to deliver adequate perfusion to meet metabolic demands. Shock is often characterized by multiorgan dysfunction and hemodynamic changes (i.e. tachycardia, hypotension). Ascending cholangitis is a serious diagnosis that carries high mortality without prompt treatment and recognition. Causes of ascending cholangitis include choledocholithiasis, a biliary tract stricture, or compression by malignant disease. Some cases demonstrate Charcot's Triad (fever, jaundice, right upper quadrant pain) or Reynolds' Pentad (Charcot's triad plus shock and altered mental status). This patient meets all five criteria of Reynolds' Pentad. Rather than a gallstone obstructing the biliary tree, this patient has an underlying malignancy that is obstructing biliary outflow (hinted by weight loss and progressive jaundice over three months). Treatment includes antibiotics, IV fluids, and surgical management. The elevated white blood cell count, fever, history, and physical exam support the diagnosis of septic shock.

Cardiogenic shock (Choice A) would be more likely in a patient with known baseline cardiac disease, a patient complaining of chest pain or shortness of breath, low ejection fraction seen on echocardiogram, and cold distal extremities. Conditions that can cause cardiogenic shock include STEMI, CHF, and myocarditis. Obstructive shock (Choice B) is seen in conditions, such as pulmonary embolism, tension pneumothorax, or cardiac tamponade. The patient's history and physical do not support this diagnosis. Hypovolemic shock (Choice D) can be caused by severe dehydration or hemorrhagic shock (a type of hypovolemic shock). This patient likely has some component of dehydration, but septic shock is the primary condition in this patient. Septic shock is a form of **Distributive shock (Choice C)**. Anaphylactic shock also is a type of Distributive shock.

References

- Nicks BA, Gaillard JP. Approach to Nontraumatic Shock. "Chapter 12: Approach to Nontraumatic Shock". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.
- Donaldson, R. (2020, May 2). Ascending cholangitis. WikEm. https://www.wikem.org/wiki/Ascending_cholangitis

Explanation – Question 7

This patient has a diagnosis of septic shock due to pneumonia. In all patients presenting to the Emergency Department, initial assessment should involve the "ABCs" (assessment of Airway, Breathing, and Circulation). The patient is given supplemental oxygen for her hypoxemia with an improved oxygen saturation from 89% to 95%. Performing endotracheal intubation (Choice A) is too aggressive at this time as the patient is improving with non-invasive oxygenation techniques.

The Centers for Medicare and Medicaid sepsis guidelines recommend a 30 mL/kg of isotonic crystalloid fluid bolus in patients with sepsis. However, there is limited data to support this recommendation as some patients may benefit from less or more fluids than 30 mL/kg. The question stem indicates that an appropriate bolus of fluids has been given, so providing more IV fluids (Choice B) is not the best course of action. The use of passive leg raising or bedside ultrasonography to assess for Inferior Vena Cava (IVC) size may help a clinician discern if more or less fluids are required. For example, visualizing a flat, collapsible IVC on ultrasound indicates additional fluids may be helpful. An increase in blood pressure after a patient's legs are raised above the level of the heart ("passive leg raise") also supports the use of additional IV fluids.

Giving acetaminophen (Choice D) will help reduce the patient's fever and improve patient comfort. However, initiating **vasopressor therapy (Choice C)**, is the more appropriate next course of action. Vasopressors (i.e. norepinephrine, epinephrine) are generally recommended after IV fluid boluses if a patient is persistently hypotensive with a MAP less than 65 mmHg. Vasopressors help to maintain cerebral and organ perfusion in states of shock. They should be titrated to a dose that maintains a MAP of 65 mmHg or above.

Reference

- Nicks BA, Gaillard JP. Approach to Nontraumatic Shock. "Chapter 12: Approach to Nontraumatic Shock". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.

Explanation – Question 8

This patient is suffering from an anticholinergic toxidrome. Symptoms of anticholinergic medication toxicity include altered mental status with agitation or delirium, tachycardia, hypertension, hyperthermia, mydriatic (dilated) pupils, hot and dry skin, decreased bowel sounds, and urinary retention.

The sympathomimetic toxidrome is very similar to the anticholinergic toxidrome; however, patients with anticholinergic ingestions have dry skin, while patients with sympathomimetic ingestions have diaphoretic skin. Some notable types of anticholinergics are atropine, antihistamines, Tricyclic antidepressants (TCAs), and Jimson weed.

Amitriptyline (Choice A) is a TCA medication and can cause anticholinergic toxicity. When taken in high doses, a major adverse effect of TCAs is Na-channel blockade, resulting in QRS widening on EKG and cardiac arrhythmias. Therapy includes sodium bicarbonate and supportive care. This patient has a normal QRS interval on EKG, making this choice less likely. Cocaine (Choice B) is a sympathomimetic. Many features of the exam support sympathomimetic toxicity, but the presence of dry skin makes this choice less likely. Physostigmine (Choice C) is an acetylcholinesterase inhibitor which would have a cholinergic toxidrome if taken in excess. Features of this include bradycardia, bronch-

orrhea, bronchospasm, diarrhea, hypersalivation, sweating, and hyperactive bowel sounds. Treatment for cholinergic toxicity is atropine. Along with supportive care, physostigmine is the main treatment for anticholinergic toxicity. One exception is in TCA toxicity where physostigmine should be avoided. **Diphenhydramine (Choice D)** is an antihistamine with anticholinergic properties, and it is the most likely medication ingested in this case scenario.

Reference

- Greene S. General Management of Poisoned Patients. "Chapter 176: General Management of Poisoned Patients". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.

Explanation – Question 9

This patient is suffering from sympathomimetic toxicity. Signs of a sympathomimetic toxidrome include agitation, psychosis, delirium, tachycardia, hypertension, diaphoresis, mydriatic (dilated) pupils, and decreased bowel sounds.

The features of anticholinergic toxidromes overlap with many features of sympathomimetic toxidromes. A clinical finding that can be used to differentiate the two toxidromes is diaphoresis. Diaphoretic skin supports sympathomimetic ingestion, while dry, warm skin supports anticholinergic ingestion. Examples of substances that can cause a sympathomimetic toxidrome are cocaine, amphetamines, synthetic cannabinoids, ketamine, bath salts, and ecstasy (MDMA). The treatment for this toxidrome is largely supportive care, such as benzodiazepines and cooling. Cocaine can cause coronary artery vasospasm and sodium-channel blockade, predisposing to cardiac arrhythmia. For this reason, a 12-lead EKG is important in any patient with possible cocaine toxicity.

Sodium bicarbonate (Choice A) would be beneficial in salicylate toxicity, tricyclic antidepressant toxicity, or cocaine toxicity if the QRS was widened. The EKG for this patient has a normal QRS interval (<120msec). Physostigmine (Choice C) is an acetylcholinesterase inhibitor. This medication would likely worsen the patient's tachycardia. Physostigmine is the antidote for anticholinergic toxicity. However, physostigmine should not be used in TCA overdose as it may increase the risk of cardiac arrhythmia. Naloxone (Choice D) is the antidote for opioid toxicity. Signs of opioid overdose include miotic (constricted) pupils, respiratory depression, and CNS depression. This patient does not possess these symptoms on physical examination. Therefore, **diazepam (Choice B)** is the best treatment.

References

- Greene S. General Management of Poisoned Patients. "Chapter 176: General Management of Poisoned Patients". In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9th ed. McGraw-Hill.
- Donaldson, R. (2019). Cocaine toxicity. WikEm. https://www.wikem.org/wiki/Cocaine_toxicity

Explanation – Question 10

This patient has narrow-complex tachycardia with a regular rhythm. A narrow QRS complex is defined as a QRS interval less than 120 msec. This is a normal finding. The differential diagnoses for regular narrow complex tachycardia include sinus tachycardia, atrial tachycardia, atrial flutter, and supraventricular tachycardia ("SVT"). SVTs are typically associated with narrow QRS complexes unless there is a concurrent bundle branch block, other aberrant conduction, or the existence of elec-

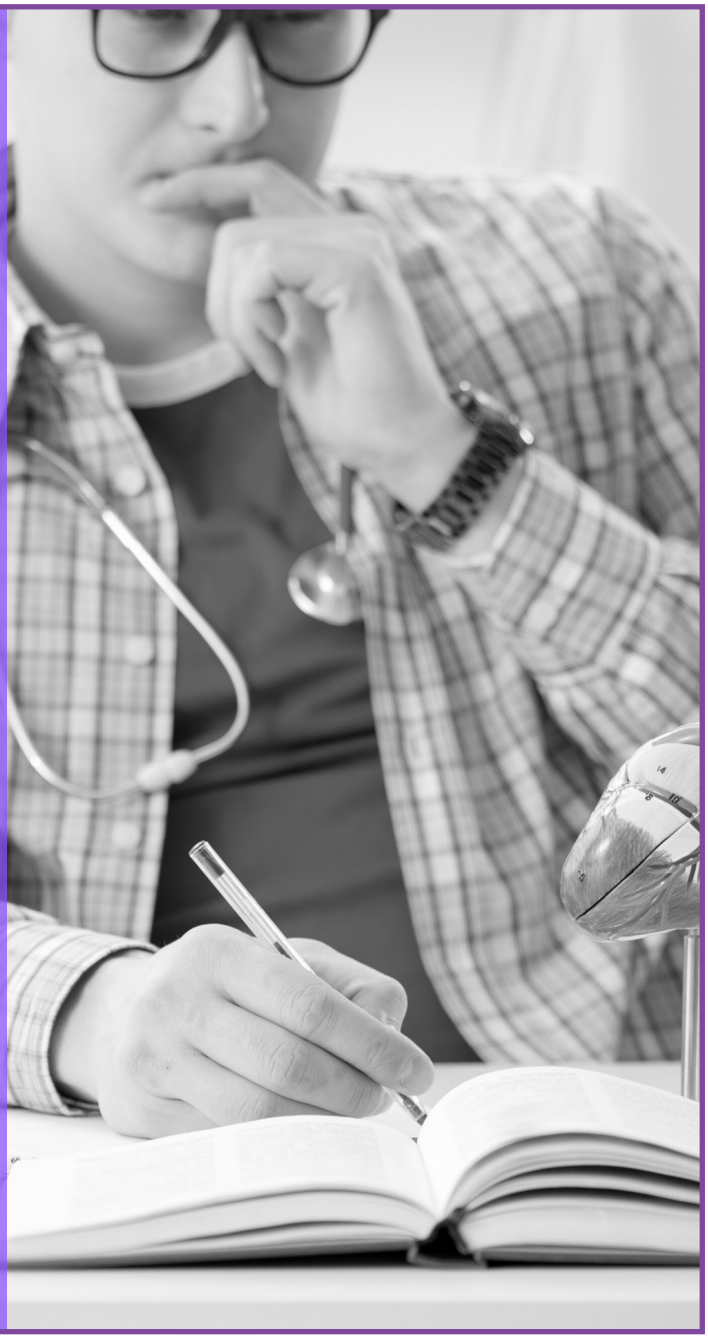
trical accessory pathways, as in Wolff Parkinson White (WPW) syndrome. The heart rate of an SVT can vary from 140-280 beats/min.

Intravenous Adenosine (Choice A) is a hallmark of SVT treatment, however, Adenosine is given after vagal maneuvers have been attempted and have failed. Synchronized cardioversion (Choice B) is a last-ditch effort treatment in a patient with SVT. Vagal maneuvers and medications are attempted prior to using cardioversion. However, if the patient is hypotensive, cardioversion should be employed. Intravenous Amiodarone (Choice C), beta-blockers, calcium channel blockers, or other antiarrhythmics can be used to terminate SVTs if vagal maneuvers and adenosine are not effective. **Vagal maneuvers (Choice D)**, such as the Valsalva maneuver ("bearing down") or carotid massage, are the initial treatment for SVTs.

References

- Burns, E. (2019, March 30). Supraventricular Tachycardia (SVT). Life in the Fast Lane. https://litfl.com/supraventricular-tachycardia-svt-ecg-library/
- Nickson, C. (2019, March 24). Narrow Complex Tachycardia. Life in the Fast Lane. https://litfl.com/narrow-complex-tachycardia/

Writing multiple-choice questions as a learning method appears to be a useful process for improving medical students' learning.



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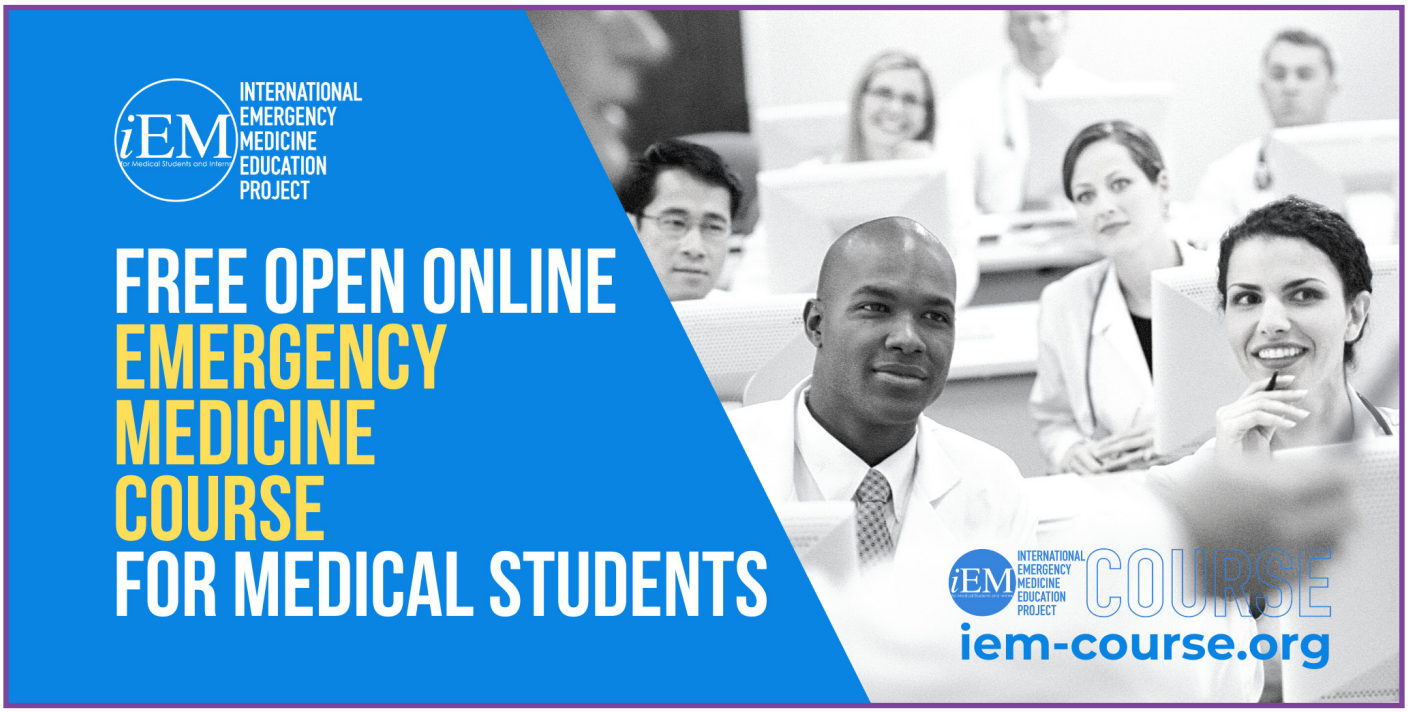
iEM
INTERNATIONAL EMERGENCY MEDICINE EDUCATION PROJECT
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iem-course.org

While online teaching is not a substitute for in-person clinical teaching, such initiatives can provide resources to clinical teachers who are overwhelmed with clinical duties and an opportunity for medical students from low-resource settings to continue their training safely during the pandemic.

Cevik AA, Cakal ED, Kwan J. From the pandemic's front lines: A social responsibility initiative to develop an international free online emergency medicine course for medical students. Afr J Emerg Med. 2021 Mar;11(1):1-2. doi: 10.1016/j.afjem.2020.11.005. Epub 2020 Dec 1. PMID: 33304802; PMCID: PMC7711205.

Question 11

A 33-year-old man presents to the Emergency Department complaining of severe, worsening substernal chest pain for 4 hours. He says he drank one pint of vodka at a party last night, then began vomiting multiple times with some blood streaking in the vomitus. He began having severe central chest pain radiating to the back after vomiting forcefully for hours. He denies any past medical or surgical history, fevers, syncope, or prior similar pain episodes. He admits to occasional alcohol use on the weekends. On examination, his temperature is 37°C, blood pressure 105/60 mmHg, pulse 115 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air. He appears uncomfortable and diaphoretic. An EKG demonstrates sinus tachycardia with no acute ischemic changes. A chest CT scan with oral water-soluble contrast is performed, which confirms the diagnosis.

Which of the following is the most appropriate next step in management for this patient's condition?

A IV antihypertensives and CT surgery consultation

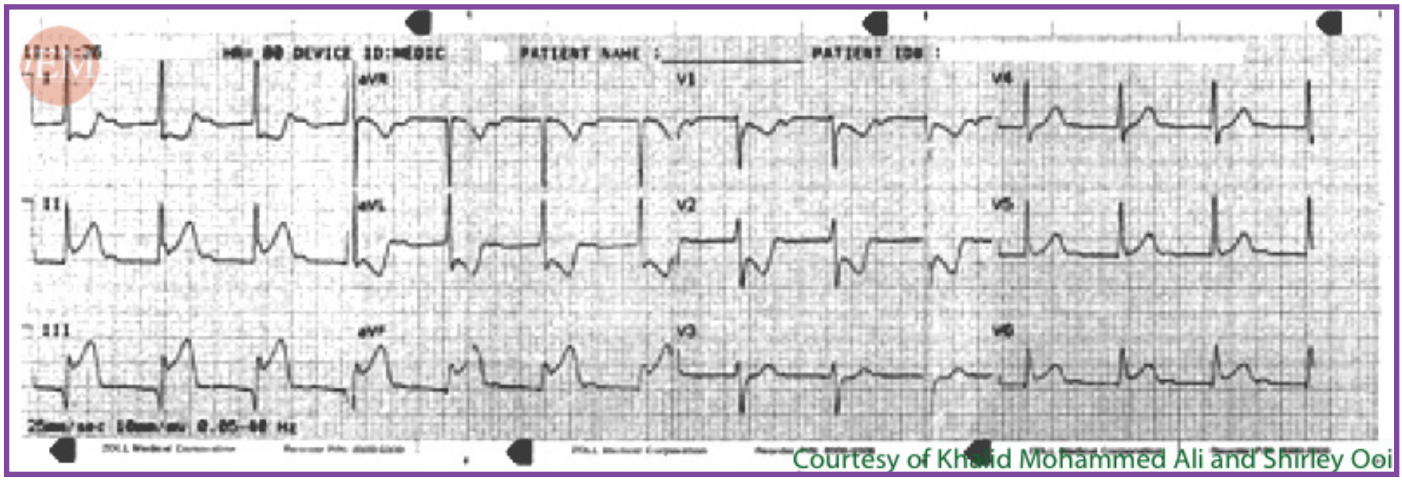
B IV Heparin

C Pericardiocentesis

D IV Fluids, antibiotics, and surgical consultation

Question 12

A 78-year-old woman presents to the Emergency Department complaining of central burning chest pain for several hours after eating dinner. The pain radiates to both shoulders and is associated with nausea and diaphoresis. Her medical history includes hypertension, diabetes, hyperlipidemia, gastroesophageal reflux disorder, and tobacco smoking since her teenage years. On physical examination, her temperature is 37°C, blood pressure 96/50 mmHg, pulse 98 beats/min, respiratory rate 20 breaths/min, oxygen saturation is 98% on room air, and blood glucose is 86 mg/dL (normal range 70-100mg/dL). An EKG is performed shortly after arrival.



Courtesy of Khalid Mohammed Ali and Shirley Ooi

Which of the following medications should be avoided to prevent worsening of this patient's condition?

A Aspirin

B Ibuprofen

C Antacids

D Nitroglycerin

Question 13

A 56-year-old man presents to the Emergency Department after a resolved 5-minute episode of chest pain. He says the pain was sharp, began gradually in the left chest, did not radiate to other locations, had no associated symptoms or worsening factors, and resolved 5 hours prior to arrival in the Emergency Department. The patient came to the hospital to get his "heart checked". His medical history includes hypertension, for which he takes amlodipine daily. He denies smoking or drug use. On examination, his temperature is 37°C, blood pressure 130/80 mmHg, pulse 75 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. A chest X-ray and blood work, including a troponin level, are performed, demonstrating no acute abnormalities. The patient's EKG is normal sinus rhythm with no acute ischemic abnormalities. He remains pain-free while in the ER.

Which of the following is the most appropriate next step in management for this patient's condition?

A Cardiology consultation

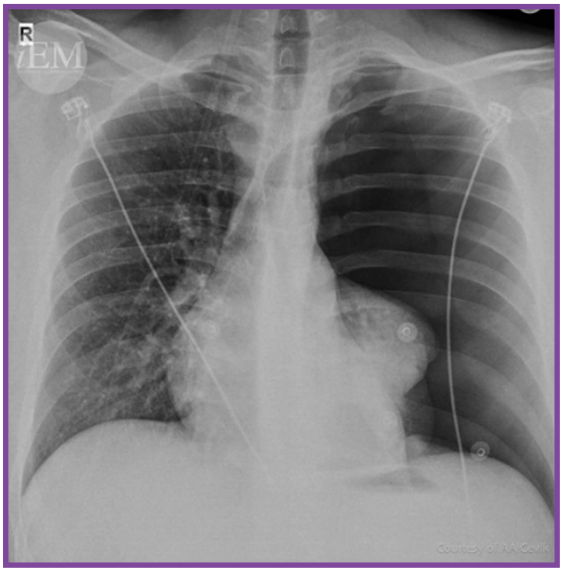
B Discharge home with prompt outpatient follow-up

C Prescribe a benzodiazepine

D Admission for cardiac stress testing

Question 14

A 72-year-old man presents to the Emergency Department complaining of sudden onset left-sided pleuritic chest pain for 2 hours in the setting of productive cough and wheezing for three days. He denies any fevers, recent travel or hospitalizations, sick contacts, hormone use, cancer history, or other complaints. He has a medical history of severe chronic obstructive pulmonary disease, hypertension and continues to smoke tobacco daily. On examination, his temperature is 37°C, blood pressure 130/80 mmHg, pulse 98 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 92% on room air. He is placed on 2 liters/min of supplemental oxygen via nasal prongs with an improved oxygen saturation of 97%. The patient's chest X-ray is below.



Which of the following is the most appropriate treatment for this patient's condition?

A Anticoagulation

B Needle decompression of the left chest

C Small-bore chest tube in the left chest

D IV antibiotics

Question 15

A 60-year-old woman presents to the Emergency Department with right-sided pleuritic chest pain and mild shortness of breath for two days. The patient denies any coughing, fevers, syncope, chest trauma, recent travel or sick contacts, recent surgeries or hospitalizations, known history of cancer, hormone use, or prior history of deep vein thrombosis (DVT) or pulmonary embolism (PE). Her medical history includes hypertension and diabetes. On examination, her temperature is 37°C, blood pressure 140/90 mmHg, pulse 108 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 97% on room air. A portable chest X-ray shows no acute findings. An EKG shows sinus tachycardia with no ischemic abnormalities. The patient remains tachycardic despite IV fluids and relocating the patient to a calm environment.

Which of the following is the best course of action to further evaluate for a diagnosis of pulmonary embolism?

A Perform a V/Q scan

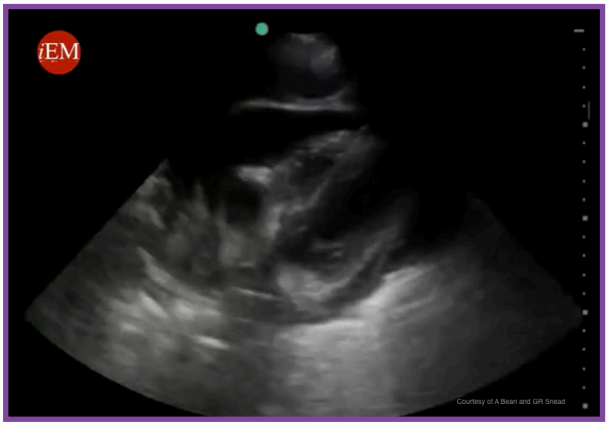
B Draw a D-Dimer test

C Perform a CT Pulmonary Angiogram

D Give lorazepam

Question 16

A 28-year-old man presents to the Emergency Department complaining of sharp left-sided chest pain and shortness of breath over the last 30 minutes. The patient was brought into the hospital as a "Level 1 Trauma" after sustaining a penetrating injury to the left chest with a 7cm knife. On examination, his temperature is 37°C, blood pressure 88/40 mmHg, pulse 125 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 98% on room air. The patient appears agitated and fearful. On a brief primary survey, the patient speaks with a clear voice, is tachypneic, and has bilateral clear breath sounds and bounding pulses in all distal extremities. Two large-bore IV lines are placed, and the nurse initiates a bolus of IV crystalloid fluids. A FAST exam is performed with one of the sonographic views demonstrated below.



Which of the following is the most appropriate next step in management for this patient's condition?

A General surgery consultation for exploratory laparotomy

B Needle decompression of the chest

C Pericardiocentesis

D CT scan of chest, abdomen, and pelvis

Question 17

A 85-year-old woman presents to the Emergency Department with intermittent palpitations for one day with accompanying chest pain. The patient denies any dizziness, syncope, fevers, shortness of breath, diaphoresis, or other complaints. She regularly uses all her baseline medications except her beta blocker, as she has run out of the prescription. The patient has a past medical history of atrial fibrillation, ischemic heart disease with three cardiac stents, diabetes, congestive heart failure, and hypertension. On examination, her temperature is 37°C, blood pressure 145/95 mmHg, pulse 130 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. She has no clinical signs of fluid overload. An EKG shows an irregularly irregular rhythm with tachycardia and nonspecific ST changes. A cardiac troponin level is drawn, which is elevated. The patient is given medication in the Emergency Department to control the heart rate and is admitted for further monitoring. Cardiac catheterization is performed while admitted to the hospital due to the patient's persistent chest pain and cardiac risk factors. There are no occlusive lesions found on cardiac catheterization.

Which of the following is the most likely cause for the patient's elevated cardiac troponin level in the Emergency Department?

A Atrial fibrillation with rapid rate

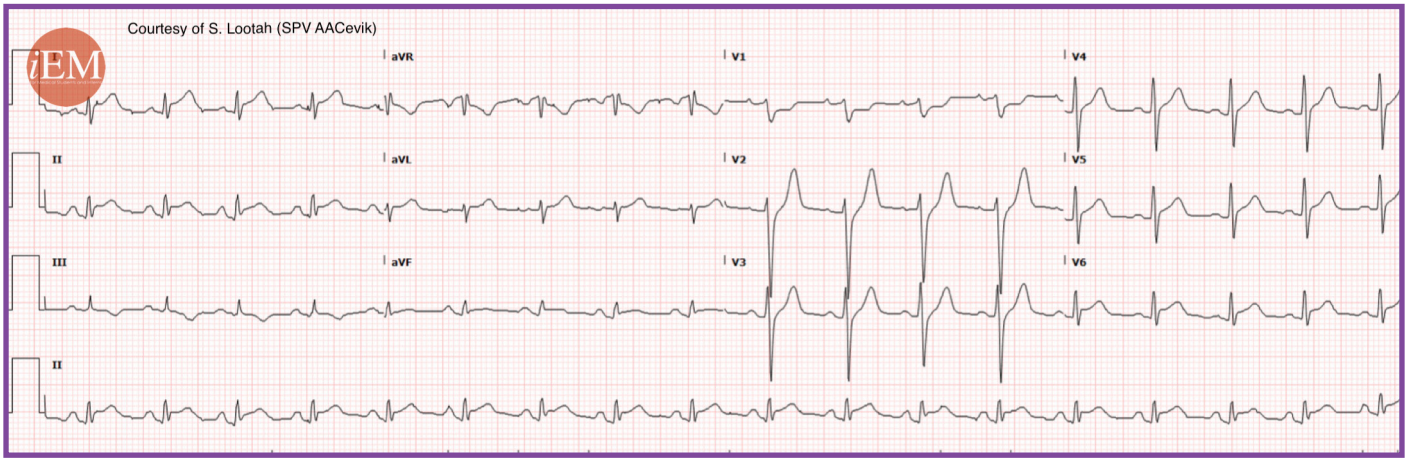
B Patient age

C Sepsis

D Acute coronary syndrome

Question 18

A 25-year-old man presents to the Emergency Department complaining of pleuritic anterior chest pain for one week along with dry cough and rhinorrhea for two weeks. He says the chest pain is worse while lying in bed at night. He denies recent travel, known sick contacts, syncope, shortness of breath, chest trauma, or other complaints. The patient has no past medical history, denies tobacco or drug use, and takes no medications regularly. On examination, his temperature is 38°C, blood pressure 120/80 mmHg, pulse 108 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. The result of a COVID-19 nasopharyngeal viral swab is negative. A 12-lead EKG is performed for the patient.



Which of the following is the most appropriate next step in management for the patient's condition?

A Aspirin

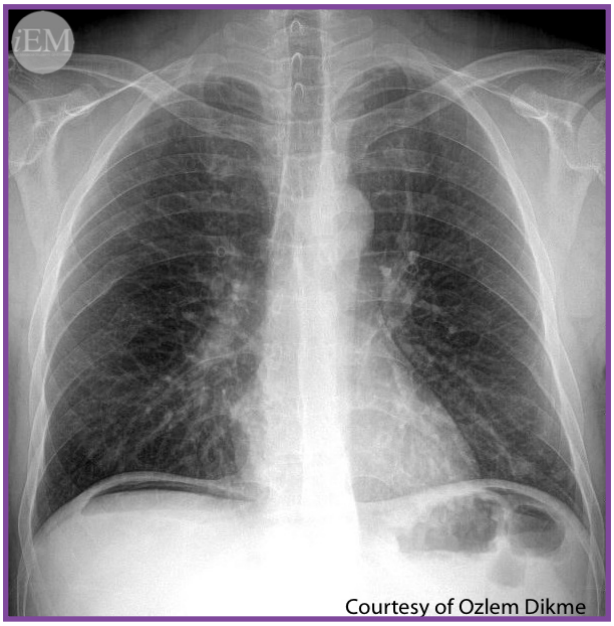
B Steroids

C Ibuprofen

D Colchicine

Question 19

A 55-year-old woman presents to the Emergency Department with one week of burning substernal chest pain with nausea. The pain is not worse with exertion, palpation of the chest, or deep breathing. The patient has a medical history of hyperlipidemia and chronic back pain, for which she has been taking NSAIDs over the last three weeks. On examination, her temperature is 37°C, blood pressure 130/80 mmHg, pulse 110 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. A 12-lead EKG shows sinus tachycardia with no acute ischemic abnormalities. Patient's Chest X-ray is demonstrated on the right.



Which of the following is the most likely cause of the patient's condition?

A Pulmonary embolism

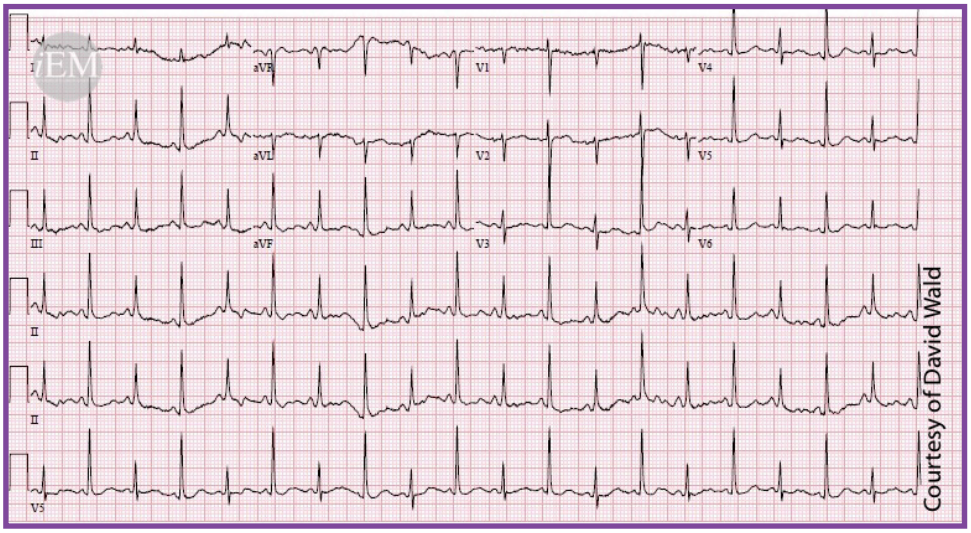
B Pancreatitis

C Peptic ulcer disease

D Gastroesophageal Reflux Disorder

Question 20

A 66-year-old woman presents to the Emergency Department with one week of shortness of breath, intermittent chest pains, and decreased exercise tolerance. She denies fevers, coughing, recent travel or hospitalizations, recent surgeries, chest trauma, or other complaints. The patient has a medical history of systemic lupus erythematosus on hydroxychloroquine and hypertension. On examination, her temperature is 37°C, blood pressure 98/60 mmHg, pulse 125 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air. A 12-lead EKG is performed and is shown below.



Which of the following is the most appropriate next investigation for this patient's condition?

A Arterial blood gas

B Bedside cardiac ultrasonography

C Chest radiography

D CT pulmonary angiography

Explanation – Question 11

IV antihypertensives and CT surgery consultation (Choice A) would be the best treatment for a patient with aortic dissection. This diagnosis is characterized by severe tearing chest pain that radiates to the back, along with hypertension. Risk factors include tobacco smoking, uncontrolled hypertension, trauma (i.e. rapid deceleration), and connective tissue diseases (i.e. Marfan syndrome). Other than chest pain with radiation to the back, this patient lacks the other risk factors for aortic dissection, making Choice A less likely. IV heparin (Choice B) would be the correct choice for the treatment of pulmonary embolism and acute coronary syndrome (i.e. NSTEMI). Both of these diagnoses are possible, but a chest CT scan with PO water-soluble contrast is not the gold standard for diagnosing PE or ACS. A CT Pulmonary angiogram is ideal for PE diagnosis, and an EKG along with troponin levels are ideal for ACS diagnosis. Pericardiocentesis (Choice C) is the treatment for cardiac tamponade. The patient's vitals show no evidence of obstructive shock, and there is no history of penetrating chest trauma, pericardial effusion, end-stage renal disease, HIV, lupus, cancer, or other risk factors for cardiac tamponade.

Choice D outlines the best course of action to take in a patient with esophageal rupture, which is the disease described in the question stem. This condition can occur spontaneously after forceful vomiting causing high pressures in the esophagus (Boerhaave syndrome). In this situation, the chest pain typically begins after the onset of vomiting. Other etiologies of esophageal rupture include deceleration injuries and penetrating trauma (i.e. gunshot wounds, iatrogenic via esophagogastroduodenoscopy (EGD)). A "Hamman's Crunch", subcutaneous emphysema, fever, and signs of shock can be seen on physical exam. Diagnosis is confirmed by an esophagram or a CT scan of the chest with water-soluble oral contrast (i.e. Gastrografin). Esophageal rupture is a life-threatening diagnosis as esophageal contents can spill into the mediastinum, causing mediastinitis and septic shock. The treatment is typically surgical with repair of the perforated segment and drainage of fluid collections.

References

- Smith LM, Mahler SA. Chest Pain. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=219641169
- Nickson, C. (2019) Oesophageal Perforation. Life in the Fast Lane. Accessed August 17, 2020. https://litfl.com/oesophageal-perforation/

Explanation – Question 12

This elderly female patient presents with chest pain described as post-prandial burning, radiating to the shoulders, and with associated nausea and diaphoresis. Burning chest pain after eating supports diagnoses such as peptic ulcer disease, gastritis, gastroesophageal reflux, or biliary disease. However, chest pain that radiates to both shoulders (2.58 likelihood ratio) or has associated diaphoresis (1.50 likelihood ratio) should be very concerning for acute myocardial infarction (Smith & Mahler, 2020). Associated symptoms that should raise concern for acute coronary syndrome are any radiation of the chest pain, pain worsened with exertion, associated nausea or vomiting, pain described as pressure or squeezing, pain with associated diaphoresis, and pain described as feeling similar to prior ischemic events. This patient's EKG demonstrates an inferior ST-segment elevation myocardial infarction (STEMI). This is indicated by two or more inferior EKG leads (II, III, and aVF) showing ST segment elevation greater than 1 mm and reciprocal ischemic changes indicated in lateral leads (I, aVL).

Aspirin (Choice A) should be given to all patients with high suspicion for ACS, assuming there are no contraindications. This patient has a confirmed STEMI on her EKG and should receive Aspirin for its antiplatelet effects. Ibuprofen (Choice B) may help the patient's pain, but likely would not acutely worsen the patient's clinical condition. Antacids (Choice C) are relatively benign medications, and they would be unlikely to worsen the patient's clinical condition.

Nitroglycerin (Choice D) is often given in patients with anginal chest pain for pain relief. In many inferior STEMIs, nitroglycerin can cause a dangerous drop in blood pressure and should be avoided. These patients may have infarction of the right ventricle which makes these patients sensitive to nitrates and prone to precipitous drops in blood pressure. IV fluids are the preferred initial therapy in the setting of hypotension. About 40% of patients with an inferior STEMI have concurrent right ventricular infarction. About 80% of inferior STEMIs are caused by occlusions in the right coronary artery (RCA) and about 18% are from an occlusion in the left circumflex artery (LCx). Occluded vessels in both territories can cause right ventricular infarction.

References

- Smith LM, Mahler SA. Chest Pain. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=219641169
- Burns, E. (2019) Inferior STEMI. Life in the Fast Lane. Accessed August 17, 2020. https://litfl.com/inferior-stemi-ecg-library/

Explanation – Question 13

This patient presents to the Emergency Department after an atypical, brief episode of chest pain. The list of potential diagnoses that may have caused the pain episodes is extensive. The focus of the Emergency Medicine practitioner should not be to determine the diagnosis per say, but rather to be to identify the presence of any life-threatening conditions (i.e. Myocardial infarction, Aortic dissection, Esophageal Rupture, Pulmonary embolism, Tension pneumothorax, Cardiac tamponade, etc.).

Many of these serious diagnoses can be evaluated with a detailed history, physical exam, and basic imaging and lab work, if needed. There are many risk stratification tools that have been developed to evaluate the likelihood of Acute Coronary Syndrome.

One well-supported tool with international validation is the HEART score tool. The HEART score categorizes a patient as low (0-3), moderate (4-6), or high risk (7-10) for a Major Adverse Cardiac Event (MACE) based on the patient's history, EKG, age, risk factors, and troponin level. The below chart from Wieters et al. (2020) outlines the HEART score categories and how to make clinical decisions based on a patient's score.

Interpretation

- Score 0–3 = 2.5 % MACE over the next 6 wk: Discharge home
- Score 4–6 = 22.3% MACE over the next 6 wk: Admit for observation
- Score 7–10 = 72.7% MACE over the next 6 wk: Admit with early invasive strategies

HEART score for cardiac risk assessment of major adverse cardiac event (MACE)

History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Significant ST depression	2
	Nonspecific repolarization disturbance	1
	Normal	0
Age	≥65 y	2
	45–65 y	1
	≤45 y	0
Risk factors	3	2
	1 or 2	1
	None	0
Troponin	≥3 times normal limit	2
	1–3 times normal limit	1
	Normal	0

The HEART score for the patient in this question would be 2 (1 point for age and 1 point for hypertension as a risk factor). This categorizes the patient as low risk for a MACE over the next six weeks. The appropriate course of action for this patient would be "discharging home" with prompt outpatient follow-up **(Choice B)**. Admission for cardiac testing (Choice D) would be warranted for a moderate-high risk HEART score. Prescribing a benzodiazepine (Choice C) would not be warranted as this patient is asymptomatic, and the pain episode is vague and atypical. Benzodiazepines are sometimes useful in patients with chest pain due to anxiety. Cardiology consultation (Choice A) would not be warranted as the patient has a low HEART score, is currently asymptomatic with normal imaging, blood work and troponin, and a normal EKG.

References

- Smith LM, Mahler SA. Chest Pain. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=219641169
- Wieters J, McDonough J, Catral J. Chest Pain. In: Stone C, Humphries RL. eds. CURRENT Diagnosis & Treatment: Emergency Medicine, 8e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2172&sectionid=165059275

Explanation – Question 14

Anticoagulation (Choice A) would be the proper treatment for pulmonary embolism, NSTEMI/STEMI, and other conditions. This patient is dyspneic and hypoxemic on physical exam, but his chest X-ray offers an alternative explanation for his symptoms.

IV antibiotics (Choice D) would be helpful for pneumonia and COPD exacerbation, both of which are possible in this patient, but his chest X-ray offers an alternative explanation for his symptoms. Needle decompression of the left chest (Choice B) would be the appropriate initial treatment for a left-sided tension pneumothorax. This patient does have a large left-sided pneumothorax, but the X-ray lacks tracheal deviation, mediastinal shift, and left hemidiaphragm flattening. Most importantly, the patient lacks the hemodynamic instability that defines tension physiology (i.e. hypotension and tachycardia). The diagnosis of tension pneumothorax should be made clinically prior to chest radiography. Signs of hemodynamic instability along with tracheal deviation, absent unilateral lung sounds, and a history of trauma all support a diagnosis of tension pneumothorax. The treatment of a tension pneumothorax requires prompt recognition, needle decompression at the 4-5th intercostal space at the mid-anterior-axillary line, and then a tube thoracostomy at the 4-5th intercostal space at the anterior axillary line. This patient has a spontaneous left-sided pneumothorax, not a tension pneumothorax. This is likely secondary to his coughing episodes and severe COPD. The treatment for this would be supplemental oxygen and the placement of a small-bore chest tube (i.e. "pig tail catheter") in the left chest **(Choice C).**

References

- Smith LM, Mahler SA. Chest Pain. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=219641169
- Nickson, C. (2019) Pneumothorax CCC. Life in the Fastlane. Accessed August 17, 2020. https://litfl.com/pneumothorax-ccc/

Explanation – Question 15

Pulmonary embolism (PE) is a potentially lethal diagnosis evaluated by a thorough history, physical exam, and risk stratification scoring tools. The Wells and PE rule-out criteria (PERC) are two well-accepted risk stratification tools for PE. These criteria are listed below (Wieters et al., 2020).

Wells score for pulmonary embolism	
Clinically suspected DVT	3
Alternative diagnosis is less likely than PE	3
Tachycardia (heart rate >100)	1.5
Immobilization at least 3 d or surgery in previous 4 weeks	1.5
History of DVT or PE	1.5
Hemoptysis	1
Malignancy with treatment within 6 months or palliative	1

Interpretation

- Score >4 = High Probability
- Score 2–4 = Moderate Probability
- Score <2 = Low Probability

PE rule-out criteria (PERC)
All Variables Must Be Present for <2% Chance of PE
Age <50
Pulse oximetry >94% (room air)
HR <100
No prior PE or DVT
No recent surgery or trauma within prior 4 week
No hemoptysis
No estrogen use
No unilateral leg swelling

The patient in this clinical vignette would have a Wells score of 1.5 (low risk) due to her persistent tachycardia of unknown etiology. The PERC rule can not be applied to this patient as she is over 50-years-old and has tachycardia. If the patient was low risk on Wells score and met all criteria of the PERC rule, she would have a less than 2% likelihood of her symptoms being due to a PE.

It is important to note that only patients with a low-risk Wells score (low pretest probability for PE) can be subjected to the PERC rule. A low-risk Wells score (<2) is investigated with a D-Dimer test **(Choice B)**, while moderate to high-risk Wells scores are investigated with a CT Pulmonary Angiogram (CTPA) (Choice C). A V/Q Scan (Choice A) is not a first-line test for diagnosing PE, as it is less sensitive than a CTPA scan. Unlike a CTPA scan, a V/Q scan may be non-diagnostic in lung consolidation, effusions, or other airspace diseases. V/Q scans are second-line tests for CTPA when there are contraindications to a CTPA (i.e. renal failure). Lorazepam (Choice D) is a benzodiazepine which may be helpful in reducing tachycardia secondary to anxiety. However, this therapy does not help further discern if the patient may have a PE.

References

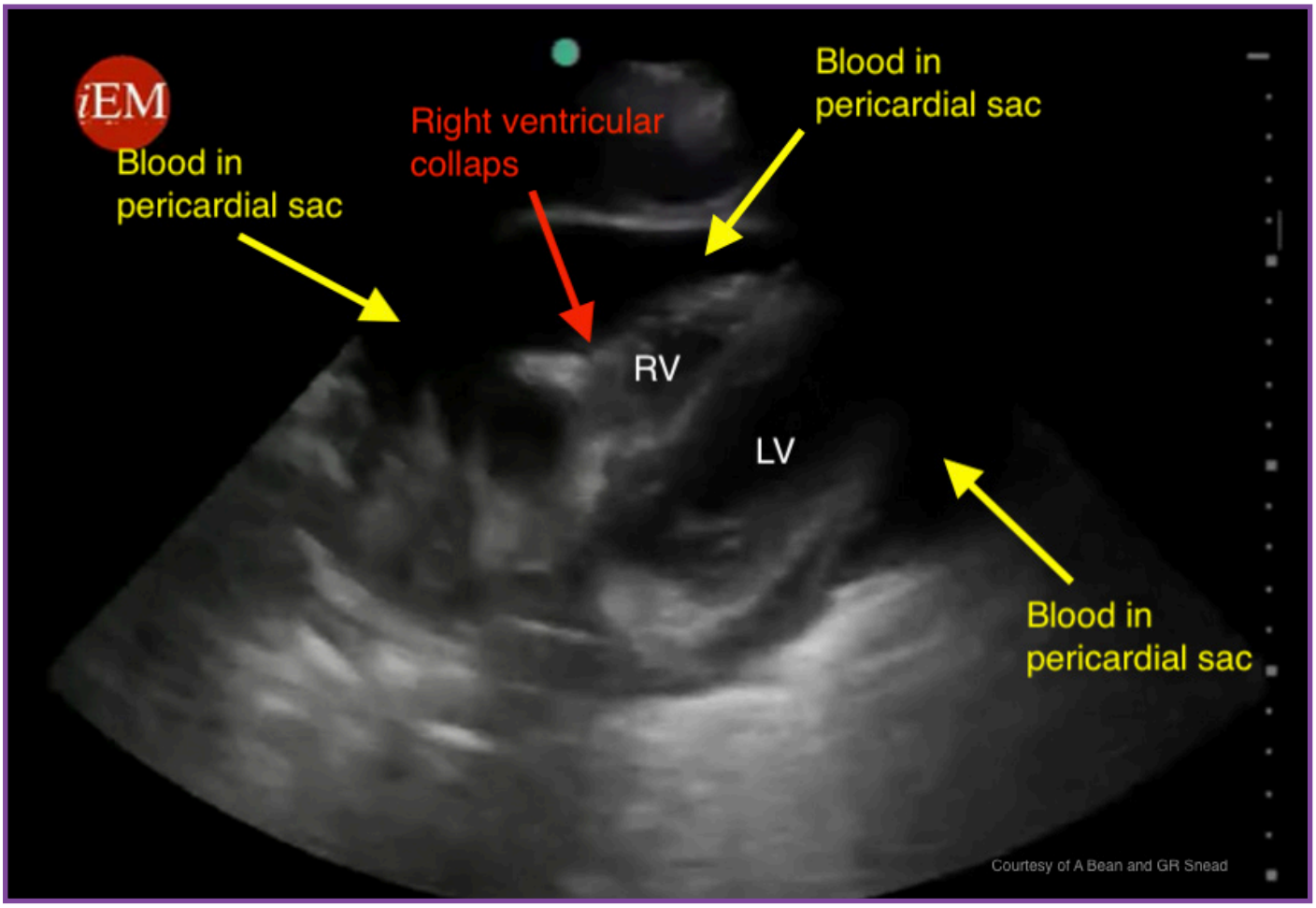
- Wieters J, McDonough J, Catral J. Chest Pain. In: Stone C, Humphries RL. eds. CURRENT Diagnosis & Treatment: Emergency Medicine, 8e. McGraw-Hill; Accessed August 17, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2172&sectionid=165059275
- Nickson, C. (2019). Pulmonary Embolism. Life in the Fastlane. Accessed on August 17, 2020. https://litfl.com/pulmonary-embolism/

Explanation – Question 16

This patient sustained a penetrating traumatic injury to the left chest and presents to the Emergency Department with hemodynamic instability (tachycardic and hypotensive). Some differential diagnoses to consider on arrival include tension pneumothorax, cardiac tamponade, aortic injury, or aero-digestive tract injury. Before taking a detailed history of any trauma patient, a primary survey should be performed. The goal of the primary survey in a trauma patient is to identify and treat any life-threatening injuries as soon as possible.

The primary survey is also known as the "ABCs". Sometimes it is referred to as the "ABCDEFs". This acronym stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam. Each letter is addressed and assessed in the order they exist in the alphabet. This creates a methodical, algorithmic approach to assist the practitioner in assessing the trauma patient for life-threatening injuries.

The sonographic view in this question is the subxiphoid (cardiac) view and demonstrates the presence of free fluid. Free fluid on ultrasound appears black, or "anechoic", and is assumed to be blood in the setting of trauma. The free fluid is highlighted by yellow arrow in the image below. Collapse of the right ventricle is shown by the red arrow in the below image.



This sonographic view, in conjunction with hemodynamic instability and a history of penetrating chest trauma, strongly supports the diagnosis of cardiac tamponade. Consulting the general surgery team for exploratory laparotomy (Choice A) would be the correct course of action for a patient with hemodynamic instability and free fluid on the other abdominal views of the FAST exam. Needle decompression of the chest (Choice B) would be the correct initial treatment for a tension pneumothorax. The patient described in the case has clear bilateral lung sounds, no tracheal deviation mentioned, normal O2 saturation on room air, and sonographic demonstration of cardiac tamponade. A CT scan of the chest, abdomen, and pelvis (Choice D) would be indicated in this patient if he had normal vital signs and no free fluid on the FAST exam.

A pericardiocentesis **(Choice C)** is the most appropriate next step in management of this patient with cardiac tamponade to relieve signs of obstructive shock. It should be noted that this procedure has limitations and is not always effective. Pericardiocentesis is a temporizing treatment with pericardotomy being the definitive therapy. Blood in an acute hemopericardium may clot and be unable to be aspirated with a large-bore needle. Surrounding organs, such as the liver, intestines, or heart itself may be injured by the procedure. Ultrasound-guidance should be used whenever possible to avoid injury

to surrounding organs. Emergent thoracotomy to relieve the cardiac tamponade should be performed on any patient with confirmed cardiac tamponade and cardiac arrest in the Emergency Department.

References

- McCaslin L, Stearley S. Chest Trauma. In: Stone C, Humphries RL. eds. CURRENT Diagnosis & Treatment: Emergency Medicine, 8e. McGraw-Hill; Accessed August 18, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2172&sectionid=165061181
- Nickson, C. (2019). Thoracic Trauma. Life in the Fastlane. Accessed August 18, 2020. https://litfl.com/thoracic-trauma/

Explanation – Question 17

Elevated cardiac troponin levels, or troponinemia, are one sign that the myocardium may be infarcting or under some type of stressful condition. Cardiac troponin levels are assessed in conjunction with the clinical history, physical exam, EKG, and other laboratory testing to decide if troponinemia is due to cardiac ischemia or another condition. Conditions associated with elevated cardiac troponin levels include cardiac ischemia (i.e. STEMI, NSTEMI), cardiac contusion, cardiac procedures, congestive heart failure, renal failure, aortic dissection, tachy- or bradyarrhythmias, rhabdomyolysis with cardiac injury, Takotsubo syndrome, pulmonary embolism, acute stroke, myocarditis, sepsis, severe burns, extreme exertion, and other conditions.

It is unlikely that this patient had elevated troponin levels from Acute coronary syndrome (Choice D) as her cardiac catheterization results showed no significant occlusive lesions in the coronary arteries. D-Dimer levels do increase with patient age, but cardiac troponin levels do not increase with patient age (Choice B). Sepsis (Choice C) is a cause for elevated troponin levels, but this patient has no clinical signs or symptoms of sepsis. Atrial fibrillation with a rapid rate **(Choice A)** is the most likely cause for this patient's elevated troponin level.

Reference

- Smith LM, Mahler SA. Chest Pain. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 18, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=219641169

Explanation – Question 18

This patient presents to the Emergency Department with signs and symptoms consistent with acute pericarditis from a likely viral etiology. Common causes of acute pericarditis include idiopathic, infectious (viral, bacterial, or fungal), malignancy, drug-induced, rheumatic disease-associated (lupus, rheumatoid arthritis, etc.), radiation, post-MI (Dressler's Syndrome), uremia, and severe hypothyroidism. The chest pain associated with this diagnosis is typically worse with supine positioning, improved with sitting forward, worse with inspiration, and may radiate to the back. A pericardial friction rub may be heard on auscultation of the chest and there may be a low-grade fever on physical examination. The hallmark EKG demonstrates diffuse ST segment elevation with PR segment depression, although normal ST segments or T wave inversions can be seen on EKG later in the disease process. The treatment of acute pericarditis depends on the underlying cause of the disease. This patient has likely viral pericarditis with no clinical signs of myocarditis (i.e. fluid overload, cardiogenic shock, etc.) or cardiac tamponade (i.e. obstructive shock, distended neck veins, muffled heart sounds, low

voltage QRS complexes or electrical alternans on EKG). A cardiac sonogram would be prudent to evaluate for a pericardial effusion.

This patient's disease course likely will resolve with NSAIDs in 1-2 weeks. Ibuprofen **(Choice C)** is the preferred treatment over aspirin (Choice A) or steroids (Choice B). Colchicine (Choice D) can be useful in recurrent episodes of pericarditis to reduce recurrence and in acute pericarditis not responding to NSAIDs.

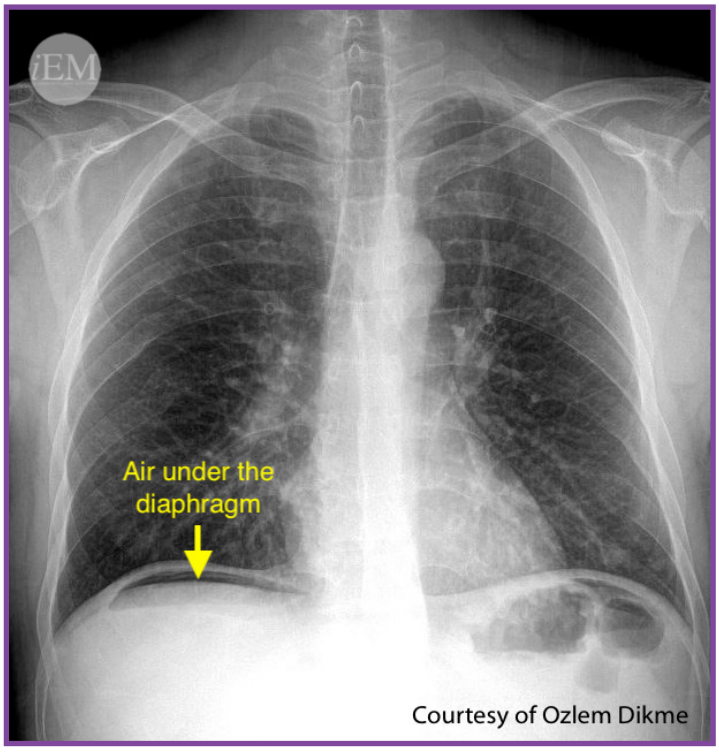
References

- Singh M, Niemann JT. Cardiomyopathies and Pericardial Disease. In: Tintinalli JE, Ma O, Yealy DM, Meckler GD, Stapczynski J, Cline DM, Thomas SH. eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill; Accessed August 18, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=218080553
- Nickson, C. (2019). Pericarditis. Life in the Fastlane. Accessed August 18, 2020. https://litfl.com/pericarditis/

Explanation – Question 19

All patients who present to the Emergency Department with chest pain should be evaluated for the top life-threatening conditions causing chest pain. Some of these include myocardial infarction, pulmonary embolism, esophageal rupture, tension pneumothorax, cardiac tamponade, and aortic dissection. Many of these diagnoses can be ruled-out or deemed less likely with a detailed history, physical examination, EKG, and sometimes imaging and blood testing. This patient presents with vague, burning chest pain, nausea, and tachycardia on physical examination.

Pulmonary embolism (Choice A) is hinted by the patient's tachycardia, but the patient has no tachypnea or risk factors mentioned for PE. Additionally, the chest X-ray findings demonstrate an abnormality that can explain the patient's symptoms.



Pancreatitis (Choice B) and Gastroesophageal reflux disorder (Choice D) are also possible diagnoses, especially with the location and description of the patient's pain. However, the Chest X-ray imaging offers an explanation for the patient's symptoms.

The patient's Chest X-ray demonstrates the presence of pneumoperitoneum. In the presence of NSAID use, this radiological finding raises concern over a perforated viscus from advanced peptic ulcer disease **(Choice C)**. Peptic ulcer disease (PUD) is most commonly caused by Helicobacter pylori infection, but NSAIDs, iron supplements, alcohol, cocaine, corrosive substance ingestions, and local infections can cause PUD. PUD is a clinical diagnosis which can be confirmed visually via endoscopy. The

treatment for PUD includes initiation of a proton pump inhibitor (H2-receptor blockers are 2nd line), avoiding the inciting agent, and H.pylori antibiotic regimens in confirmed H.pylori cases. The treatment for a perforated peptic ulcer with pneumoperitoneum is IV fluids, IV antibiotics, Nasogastric tube placement, and surgical consultation for repair.

References

- McAninch S, Smithson III CC. Gastrointestinal Emergencies. In: Stone C, Humphries RL. eds. CURRENT Diagnosis & Treatment: Emergency Medicine, 8e. McGraw-Hill; Accessed August 18, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2172&sectionid=165065027
- Nickson, C. (2019). Chest pain DDx. Life in the Fastlane. Accessed August 18, 2020. https://litfl.com/chest-pain-ddx/

Explanation – Question 20

This patient's EKG demonstrates alternating amplitudes of QRS complexes, a phenomenon known as electrical alternans. This is caused by the heart swinging back and forth within a large pericardial effusion. The patient is tachycardic and borderline hypotensive, which should raise concern over impending cardiac tamponade. Other EKG signs of a large pericardial effusion are diffusely low QRS voltages and sinus tachycardia.

The next best investigation to definitively diagnose a large pericardial effusion with possible tamponade would be cardiac ultrasonography **(Choice B)**. This investigation could also guide treatment with pericardiocentesis in the event of hemodynamic decompensation and the development of obstructive shock. Chest radiography (Choice C) may show an enlarged cardiac silhouette in this case and evaluate for alternative diagnoses (i.e. pneumothorax, pleural effusions, pneumonia, atelectasis), however, cardiac echocardiography is the best next investigation. CT pulmonary angiography (Choice D) would demonstrate the presence of a pericardial effusion along with differences in cardiac chamber size indicative of tamponade, but bedside cardiac sonogram is a faster test that prevents a delay in diagnosis. Sending a potentially unstable patient for a CT scan may also be dangerous. Arterial blood gas testing (Choice A) has no role in diagnosing pericardial effusion or cardiac tamponade.

References

- Imazio M. Pericardial Diseases. In: Crawford MH. eds. CURRENT Diagnosis & Treatment: Cardiology, 5e. McGraw-Hill; Accessed August 18, 2020. https://accessmedicine.mhmedical.com/content.aspx?bookid=2040&sectionid=152996466
- Burns, E. (2019). ECG Findings in Massive Pericardial Effusion. Life in the Fastlane. Accessed on August 18, 2020. https://litfl.com/ecg-findings-in-massive-pericardial-effusion/

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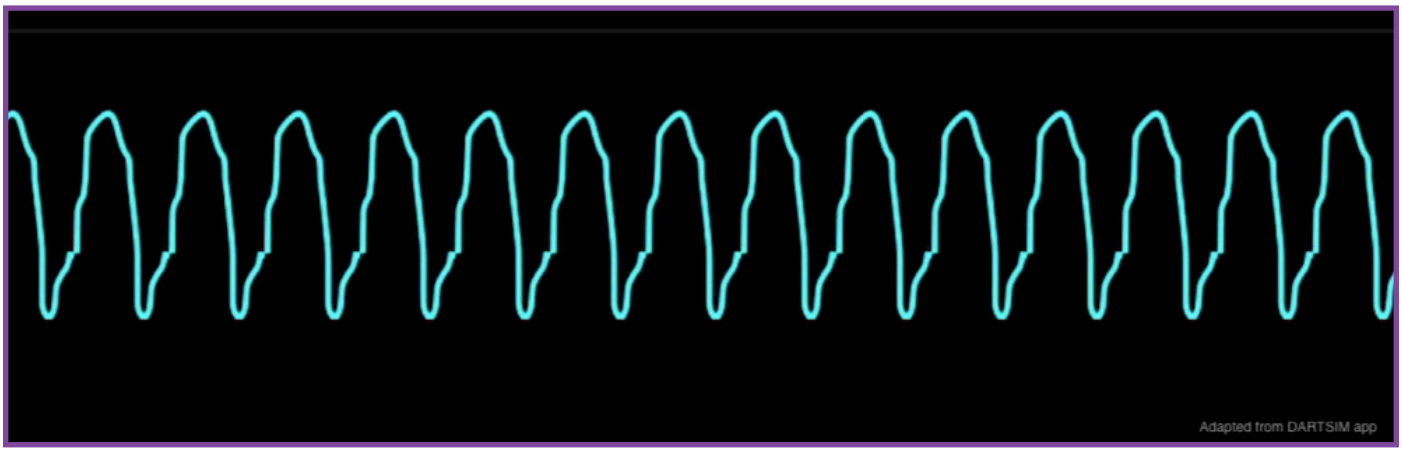
Question 21

An 82-year-old woman presents to the Emergency Department after a witnessed cardiac arrest at home. The patient suddenly collapsed at home after experiencing chest pain. Emergency Medical Services were notified of the event, chest compressions were initiated on arrival by pre-hospital providers, and the patient was intubated during transport to the hospital. On arrival in the Emergency Department, compressions are continued, and 1 mg of intravenous epinephrine is administered. Ambulance personnel report the patient's medical history to include hypertension, coronary artery disease, and diabetes. On examination, her temperature is 36°C and all other vital signs are unmeasurable. The cardiac rhythm is noted during a pulse check (see image) and a 200 Joule unsynchronized cardioversion is delivered.

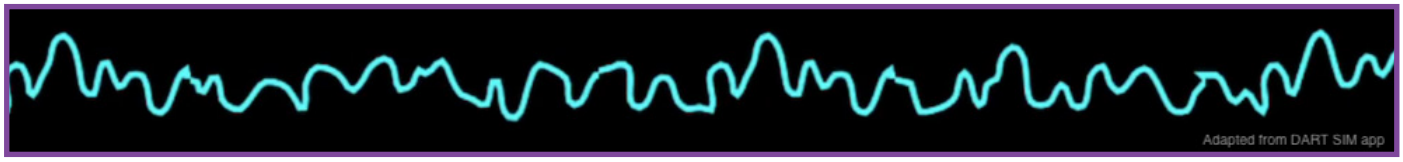


Which of the following is the most appropriate next step in management for this patient's condition?

A. Watch the cardiac monitor for a rhythm change
B. Continue chest compressions
C. Administer intravenous adrenaline
D. Check for a pulse

Question 22

A 68-year-old man presents to the Emergency Department after a witnessed collapse outside of the hospital. Chest compressions are immediately initiated by hospital staff and 1 mg of intravenous epinephrine is administered. Physicians prepare to establish a definitive airway. After 2 minutes of CPR, no pulse is palpated. The patient's medical history is unknown. On examination, his temperature is 36°C and other vital signs are unmeasurable. The cardiac rhythm seen during the pulse check is below.

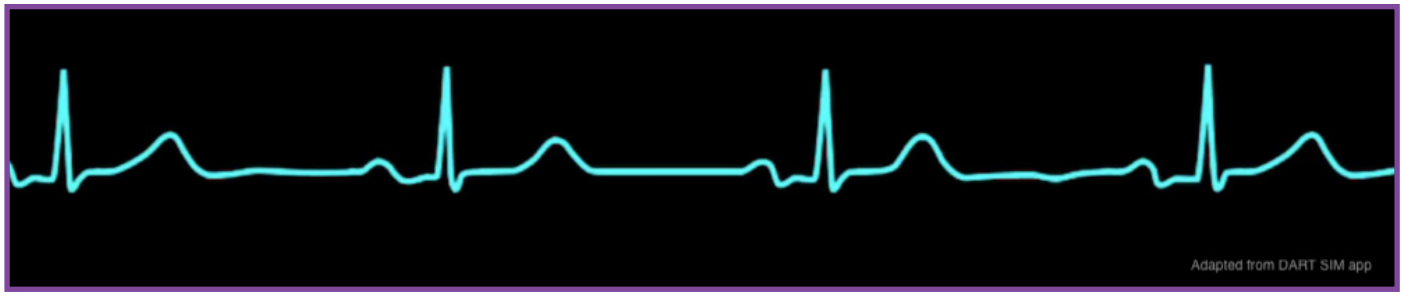


Which of the following is the most appropriate next step in management for this patient's condition?

A. Continue chest compressions
B. Perform unsynchronized cardioversion at 200 Joules
C. Administer Amiodarone
D. Administer Sodium Bicarbonate

Question 23

A 57-year-old man presents to the Emergency Department with atraumatic pleuritic chest pain and dyspnea that began 3 hours prior to arrival. His medical history includes hypertension, diabetes, pancreatic cancer, and hypothyroidism. He denies recent fevers, coughing, blood in stool, or surgeries within the last six months. As you prepare to examine the patient, he becomes unresponsive, limp, and pulseless. Chest compressions are immediately initiated, and 1 mg of intravenous epinephrine is administered. On examination, his temperature is 36°C and other vital signs are unmeasurable. The cardiac rhythm seen during the pulse check is below (no pulse present).



Which of the following is the most appropriate next step in management for this patient's condition?

A Administer intravenous sodium bicarbonate

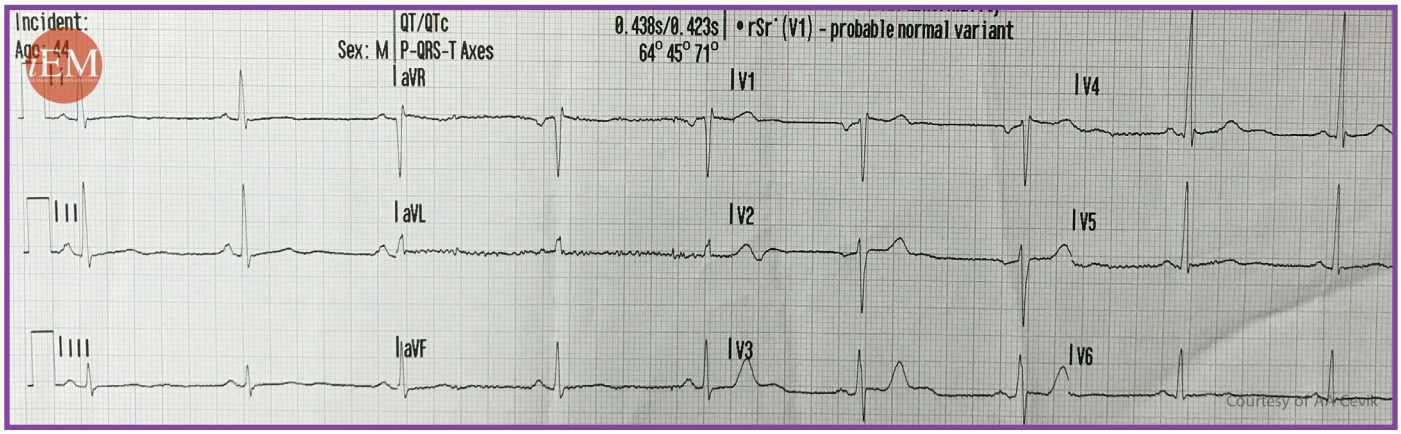
B Administer intravenous calcium gluconate

C Administer thrombolytics

D Administer blood products

Question 24

A 66-year-old woman presents to the Emergency Department complaining of feeling lightheaded and dizzy for five hours. She denies any syncopal episodes, chest pain, recent medication changes, drug use, vomiting, or diarrhea. The patient has a medical history of diabetes, hypertension, and ischemic heart disease with two cardiac stents. On examination, her temperature is 37°C, blood pressure 85/40 mmHg, pulse 38 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. She appears confused and disoriented. A 12-lead EKG for this patient is below.



Which of the following is the most appropriate next step in management for this patient's condition?

A Transcutaneous pacing

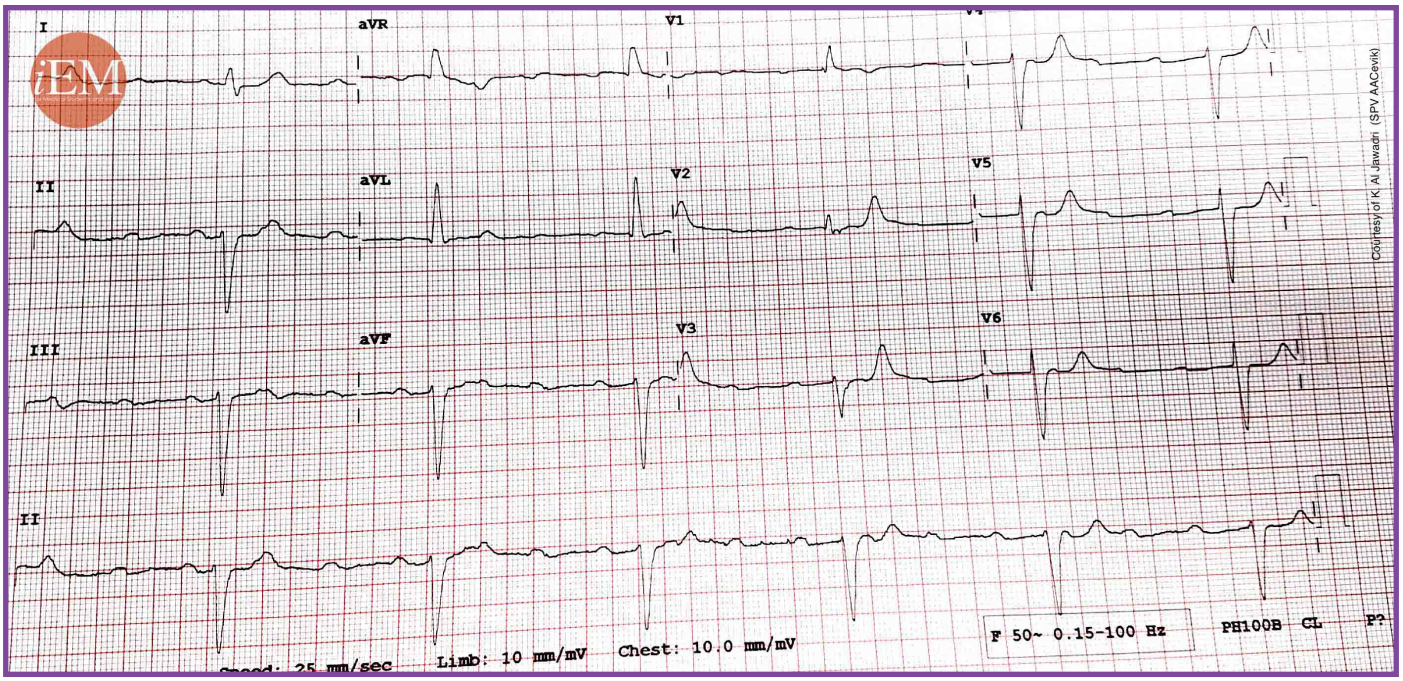
B Transvenous pacing

C IV Amiodarone

D IV Metoprolol

Question 25

A 80-year-old woman presents to the Emergency Department complaining of intermittent dizziness for one day. She denies any chest pain, new medications, changes in home medications, drug use, or syncope. Her medical history includes hyperlipidemia, hypertension, diabetes, chronic obstructive lung disease, and coronary artery disease. On examination, her temperature is 37°C, blood pressure 95/60 mmHg, pulse 30 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. The patient is not confused on examination. A 12-lead EKG for this patient is below.



Which of the following is the most likely diagnosis of this patient's condition?

A Sinus bradycardia

B First-Degree AV Block

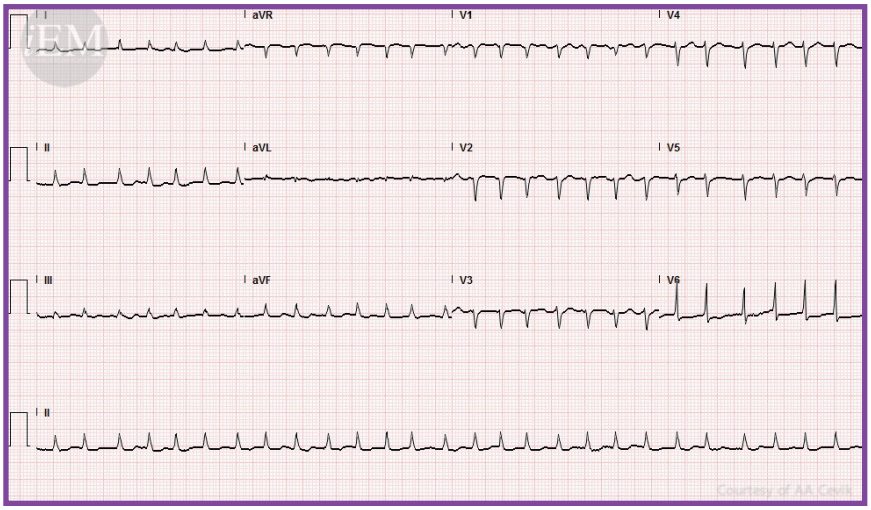
C Second-Degree AV Block (Mobitz type II)

D Third-Degree AV Block

Question 26

A 82-year-old woman presents to the Emergency Department complaining of a sensation of "heart racing" intermittently over the last four days. The patient denies any syncope, dizziness, chest pain, dyspnea, fevers, or new medications. Her medical history includes hypertension, diabetes, and congestive heart failure. On examination, her temperature is 37°C, blood pressure 110/80 mmHg, pulse 155 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 97% on room air. A 12-lead EKG for this patient is below.

Which of the following is the most appropriate next step in management for this patient's condition?



A Electrical cardioversion

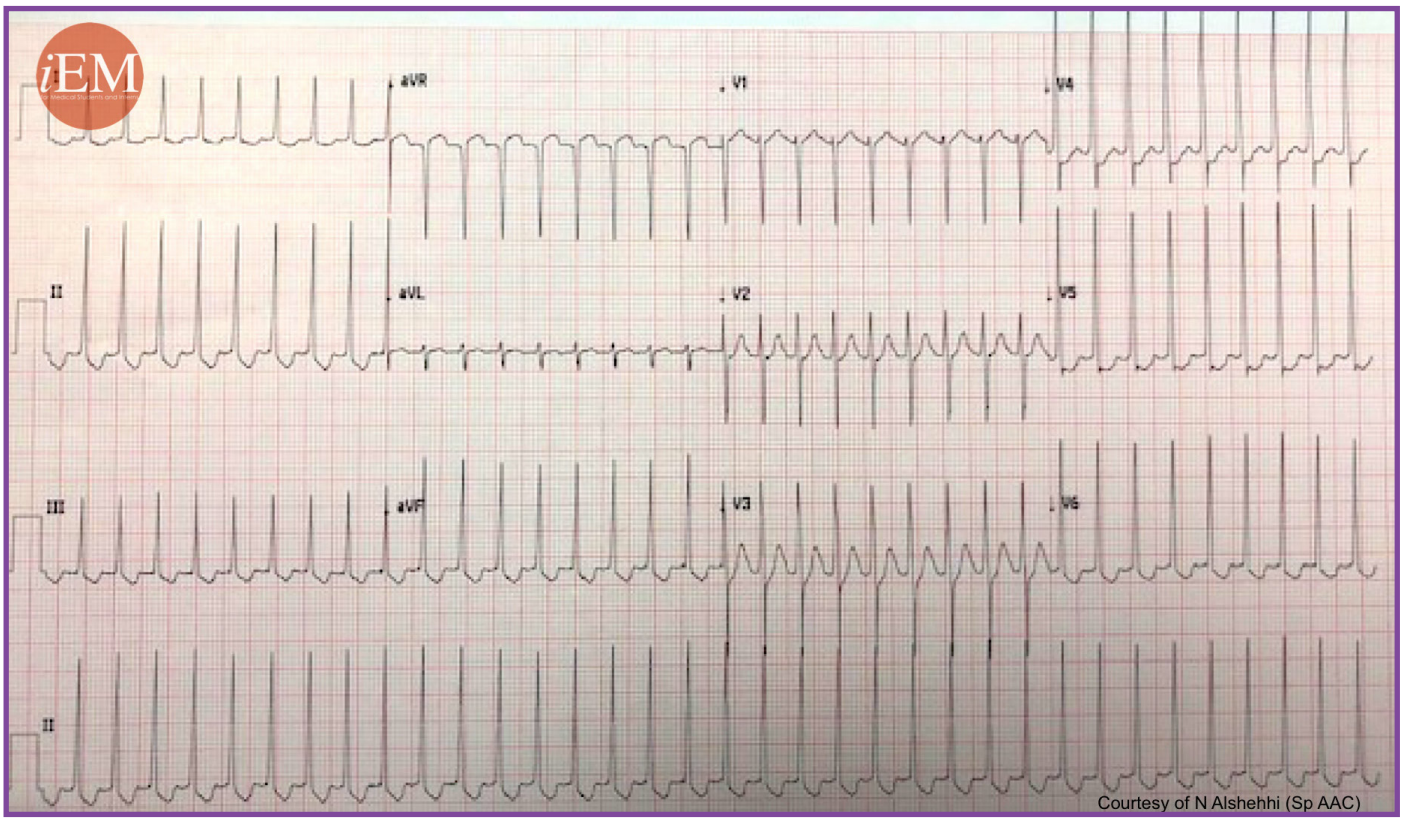
B Intravenous Metoprolol

C General observation

D Intravenous Adenosine

Question 27

A 24-year-old woman presents to the Emergency Department complaining of constant palpitations for 4 hours. She looks tired and describes lightheadedness and mild chest tightness but denies any syncope, dyspnea, fevers, illicit drug use, or new medications. She lacks any past medical history. On examination, her temperature is 37°C, blood pressure 85/56 mmHg, pulse 180 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air. A 12-lead EKG for this patient is below.



Which of the following is the most appropriate next step in management for this patient's condition?

A Syncronized cardioversion

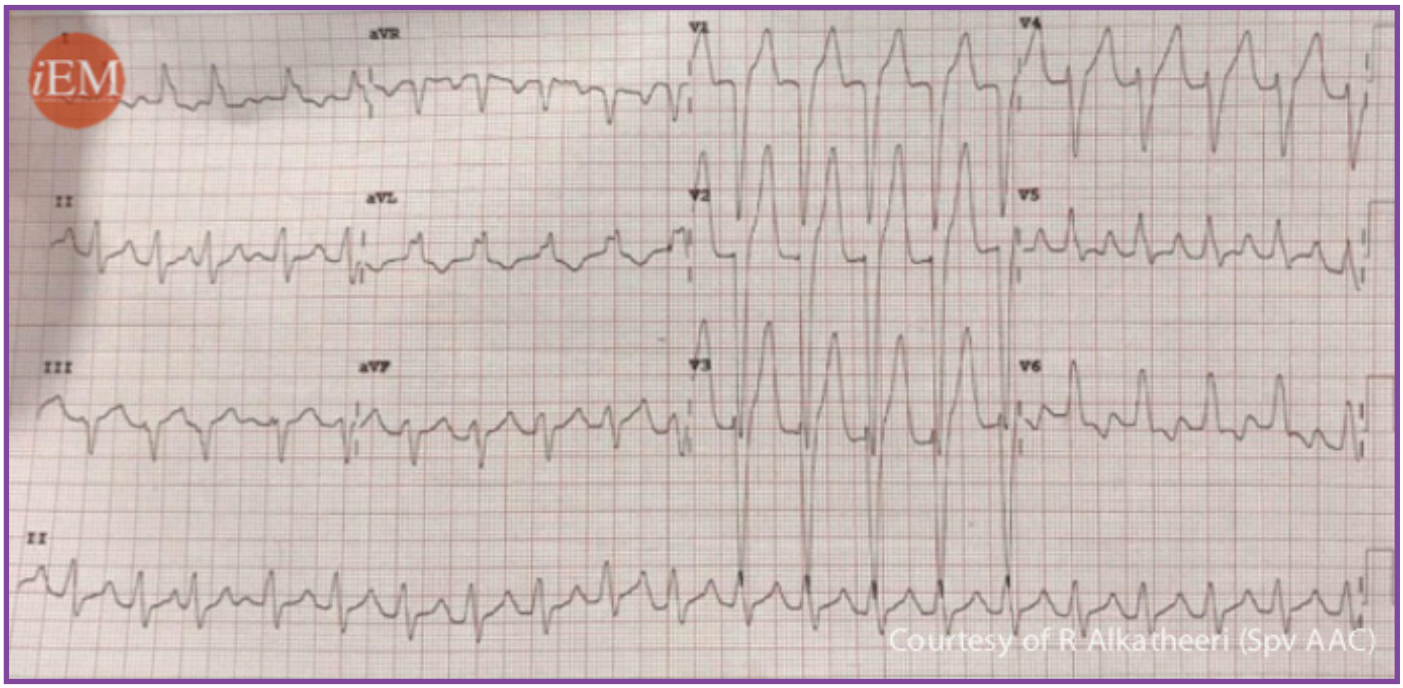
B Valsalva maneuver

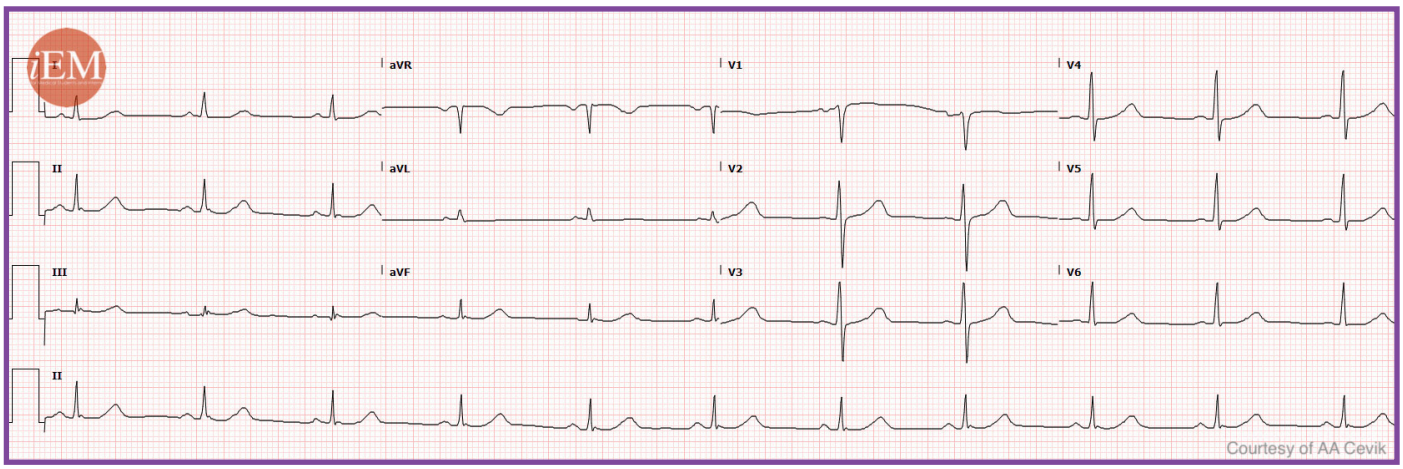
C Intravenous Metoprolol

D Intravenous Diltiazem

Question 28

A 68-year-old man presents to the Emergency Department complaining of fatigue, nausea, and palpitations for one day. He denies vomiting, fevers, chest pain, syncope, illicit drug use, or recent medication changes. His medical history includes hypertension, diabetes, chronic kidney disease, ischemic heart disease, and anxiety. On examination, his temperature is 37°C, blood pressure 160/100 mmHg, pulse 145 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 97% on room air. A 12-lead EKG is performed on initial evaluation (EKG #1). A prior EKG performed on the same patient one year ago is below for reference (EKG #2).





Which of the following is the most likely underlying cause for this patient's condition?

A Ischemic heart disease

B Wolff Parkinson White Syndrome

C Chronic kidney disease

D Anxiety

Question 29

A 40-year-old man presents to the Emergency Department complaining of severe vomiting, diarrhea, and fatigue for one week. He has crampy diffuse abdominal pains associated with vomiting and diarrhea episodes but denies fevers, recent travel, new medications, or syncope. He denies any past medical history. On examination, his temperature is 37°C, blood pressure 95/60 mmHg, pulse 115 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. While you are preparing to examine the patient, he becomes briefly unresponsive and then regains consciousness. Intravenous fluids are started, and a 12-lead EKG is performed. The EKG for this patient is below.

Which of the following is the most appropriate next step in management for this patient?

A Intravenous Amiodarone

B Intravenous Procainamide

C Intravenous Ciprofloxacin

D Intravenous Magnesium Sulfate

Question 30

A 52-year-old man presents to the Emergency Department after a witnessed collapse in a supermarket. Bystanders note the patient clenched his chest in pain prior to collapsing. Bystanders immediately initiated chest compressions and called for emergency pre-hospital medical providers. On arrival of pre-hospital providers, the patient was intubated and was found to be in ventricular fibrillation. Electrical defibrillation was delivered with a successful return of spontaneous circulation. The patient has a medical history of hypertension, diabetes, ischemic heart disease, and congestive heart failure. On examination, his temperature is 36°C, blood pressure 150/90 mmHg, pulse 98 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on 100% FiO2. The patient is intubated, unresponsive to pain, and has mid-sized pupils that constrict sluggishly to light. A 12-lead EKG shows normal sinus rhythm with no signs of an ST-elevation myocardial infarction. The patient's wife says that he would want full resuscitative efforts.

Which of the following is the next best step in management for this patient?

A Terminate all resuscitative efforts due to medical futility

B Initiate vasopressors

C Prepare for Targeted Temperature Management

D Order CT scan of head for possible Intracranial bleeding

High-fidelity simulation training is superior to low-fidelity CPR manikin training for teaching fourth-year medical students implementation of high-quality CPR for chest compression depth and compression fraction.

McCoy CE, Rahman A, Rendon JC, Anderson CL, Langdorf MI, Lotfipour S, Chakravarthy B. Randomized Controlled Trial of Simulation vs. Standard Training for Teaching Medical Students High-quality Cardiopulmonary Resuscitation. West J Emerg Med. 2019 Jan;20(1):15-22. doi: 10.5811/westjem.2018.11.39040. Epub 2018 Dec 12. PMID: 30643596; PMCID: PMC6324716.

Explanation – Question 21

This patient experienced a witnessed cardiac arrest at home, after which pre-hospital providers initiated cardiopulmonary resuscitation (CPR, or "chest compressions") and Advanced Cardiovascular Life Support (ACLS). ACLS includes the tenets of Basic Life Support (BLS), such as early initiation of high-quality CPR at a rate of 100-120 compressions/minute, compressing the chest to a depth of 5 cm (2 inches), providing 2 rescue breaths after every 30 compressions (30:2 ratio), avoiding interruptions to CPR, and allowing for adequate chest recoil after each compression.

In the ACLS algorithm, intravenous epinephrine is administered every 3-5 minutes and a "pulse check" is performed after every 2 minutes of CPR. The patient's cardiac rhythm, along with the clinical history, helps decide if the patient should receive defibrillation ("electrical shock") or additional medications. The ACLS algorithm divides management into patients with pulseless ventricular tachycardia (pVT) or ventricular fibrillation (VF) and patients with pulseless electric activity (PEA) or asystole.

The cardiac rhythm seen during the pulse check for this patient is a wide complex tachycardia with a regular rhythm. In the setting of cardiac arrest, chest pain prior to collapse, and a history of acute coronary syndrome, ventricular tachycardia is the most likely cause. The ACLS algorithm advises unsynchronized cardioversion at 150-200 Joules for patients with pVT or VF.

Watching the cardiac monitor for a rhythm change (Choice A) or checking for a pulse (Choice D) are not recommended after defibrillation. A major priority of both BLS and ACLS is to avoid interruptions to CPR, so the best next step in management is to continue CPR (Choice B) after defibrillation. The administration of intravenous adrenaline (Choice C) is recommended after every 2 cycles of CPR or every 3-5 minutes in the cardiac arrest patient. Adrenaline cannot circulate throughout the body without CPR, so continuing CPR (Choice B) should be prioritized.

Calcium gluconate is another drug that can be used in patients with hyperkalemia and indicated in a patient with known kidney disease, missed hemodialysis sessions, or a history of usage of medications that can cause hyperkalemia. Magnesium can be used for patients who show polymorphic VT, particularly Torsades de Pointes. The next best step in this scenario is to continue CPR **(Choice B)**, regardless of the etiology of the cardiac arrest.

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Explanation – Question 22

This patient presents to the Emergency Department after a cardiac arrest with an unknown medical history. Important components of Basic Life Support (BLS) include early initiation of high-quality CPR at a rate of 100-120 compressions/minute, compressing the chest to a depth of 5 cm (5 inches), providing 2 rescue breaths after every 30 compressions (30:2 ratio), avoiding interruptions to CPR, and allowing for adequate chest recoil after each compression.

In the Advanced Cardiovascular Life Support (ACLS) algorithm, intravenous epinephrine is administered every 3-5 minutes and a "pulse check" is performed after every 2 minutes of CPR. The patient's cardiac rhythm, along with the clinical history, helps decide if the patient should receive additional medications or receive unsynchronized cardioversion (defibrillation, or "electrical shock).

The ACLS algorithm divides management in patients with pulseless ventricular tachycardia (pVT) or ventricular fibrillation (VF) and patients with pulseless electric activity (PEA) or asystole. The cardiac rhythm seen during the pulse check for this patient is ventricular fibrillation. The ACLS algorithm advises unsynchronized cardioversion at 150-200 Joules for patients with pVT or VF. Continuing chest compressions (Choice A) with minimal interruptions is a crucial component of BLS, however, this patient's cardiac rhythm is shockable.

Defibrillation **(Choice B)** takes precedence over CPR in this scenario. Amiodarone (Choice C) is an antiarrhythmic agent that is recommended in patients with pVT, in addition to unsynchronized cardioversion. This patient has VF, not pVT. Sodium bicarbonate (Choice D) is an alkaline medication that is helpful in cardiac arrests caused by severe acidosis or certain toxins (i.e. salicylates or tricyclic antidepressants). The next best step in this patient scenario would be defibrillation for the patient's VF (Choice B).

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Explanation – Question 23

This patient presented to the Emergency Department with acute pleuritic chest pain, dyspnea, and experienced a cardiac arrest prior to a detailed physical examination. The cardiac monitor shows a narrow complex sinus rhythm morphology. In the setting of a cardiac arrest and pulselessness, this cardiac rhythm is known as pulseless electric activity (PEA). PEA includes any cardiac rhythm that is not asystole, ventricular fibrillation, or pulseless ventricular tachycardia.

The ACLS algorithm divides the management of patients with pulseless ventricular tachycardia (pVT) or ventricular fibrillation (VF) and patients with pulseless electric activity (PEA) or asystole. Assuming adequate staff and medical resources are present, patients with all of these rhythms receive high-quality CPR, IV epinephrine, and airway management. Patients with pVT or VF receive electri-

cal cardioversion, while patients with PEA or asystole do not receive electrical cardioversion. Patients with PEA or asystole generally have a poorer prognosis than those with pVT or VF.

Out of hospital cardiac arrests that present to the Emergency Department with PEA or asystole on initial rhythm have a survival rate of under 3%. The etiology of PEA in cardiac arrest includes a wide variety of causes. A traditional approach to remembering the reversible causes of PEA are the "Hs & Ts". The list of the "Hs & Ts" along with their individual treatments are listed in the table below.

"Five Hs"	Treatment	"Five Ts"	Treatment
Hypoxia	Intubation and ventilation	**Toxins**	Antidote for specific drug Stop absorption Increase Elimination
Hypovolemia	Fluids, blood products, control bleeding if present	**Tamponade (cardiac)**	Pericardiocentesis
Hydrogen ion excess (acidosis)	Sodium bicarbonate	**Tension pneumothorax**	Needle decompression of chest & chest tube placement
Hyperkalemia	IV Ca-gluconate Insulin + dextrose Sodium Bicarbonate Treat underlying cause	**Thrombosis (cardiac, i.e. STEMI)**	For STEMI - Cardiac catheterization or thrombolysis (tPA)
Hypokalemia	K+ repletion	**Thrombosis (pulmonary, i.e. PE)**	Cardiac catheterization or thrombolysis (tPA)
Hypothermia	Warm patient		For PE- Thrombolysis (tPA) and possible surgical embolectomy

Sodium bicarbonate (Choice A) would be the correct choice for a patient whose PEA arrest was caused by severe acidosis. This can occur in severe lactic acidosis (i.e. sepsis), diabetic ketoacidosis, certain toxic ingestions (i.e. iron, salicylates, tricyclic antidepressants), as well as other causes. Calcium gluconate (Choice B) would be the correct choice for a patient whose PEA arrest was cause by hyperkalemia. This can occur in renal failure, in the setting of certain medications, rhabdomyolysis (muscle tissue breakdown), and other causes. Blood products (Choice D) would be the correct choice for a patient whose PEA arrest was due to severe hemorrhage, such as gastrointestinal bleeding or in the setting of traumatic injuries. This patient has symptoms and risk factors for pulmonary embolism, including pleuritic chest pain, dyspnea, and a cancer history. These details make pulmonary embolism the most likely cause of PEA arrest in this scenario. The best treatment for this diagnosis would be thrombolysis **(Choice C)**.

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Explanation – Question 24

This patient is suffering from severe bradycardia with signs of poor cardiac output, shock, and diminished perfusion to the brain. Bradycardia is defined as any heart rate under 60 beats/min. Many individuals may be bradycardic at rest with no danger to the patient (i.e. young patients or athletes). Bradycardia in these scenarios is physiologic and is not associated with difficulty in perfusing the brain and other organs. This patient's 12-lead EKG shows sinus bradycardia since there is a P wave prior to every QRS complex. Sinus bradycardia is the most common type of bradycardia. Other types of bradycardia include conduction blocks (i.e. type 2 or type 3 AV blocks), junctional rhythms (lack of P waves with slow SA nodal conduction), idioventricular rhythms (wide QRS complex rhythms that originate from the ventricles, not atria), or slow atrial fibrillation or atrial flutter. About 80% of all bradycardias are caused by factors external to the cardiac conduction system, such as hypoxia, drug effects (i.e. beta block or calcium channel blocker use or overdose), or acute coronary syndromes.

For any patient with a bradyarrhythmia or tachyarrhythmia, it is crucial to determine if the arrhythmia is "stable" or "unstable". Signs that an arrhythmia is unstable include altered mental status, hypotension with a systolic blood pressure under 90 mmHg, chest pain, or shortness of breath. Patients with a stable arrhythmia can be managed supportively with observation and less invasive medical management. Patients with an unstable arrhythmia are managed more aggressively with the use of electricity, often in combination with other medical treatments. This patient has an unstable bradyarrhythmia given her altered mental status and hypotension. Intravenous metoprolol (Choice D) would make the patient more bradycardic, since this medication blocks beta-adrenergic receptors of the heart that control heart rate and contractility. Intravenous Amiodarone (Choice C) is an antiarrhythmic agent used often in wide complex tachyarrhythmias (i.e. Ventricular Tachycardia). Intravenous atropine or epinephrine are agents that can be used in this patient prior to preparing for electric pacing.

Transcutaneous pacing (Choice A) should always be attempted prior to Transvenous pacing (Choice B), as Transcutaneous pacing is less invasive and quicker to set up. If Transcutaneous pacing does not result in electrical "capture" or change the heart rate, the next step is Transvenous pacing **(Choice A)**.

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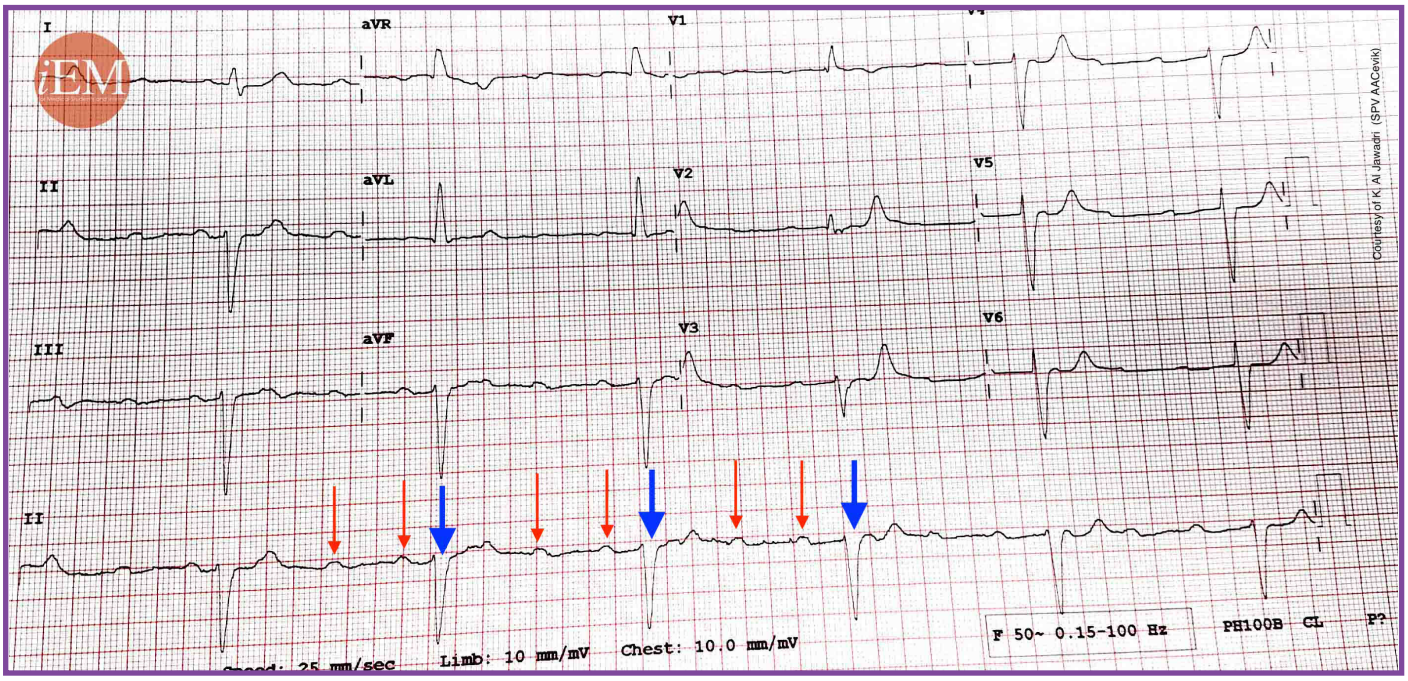
- Burns, E. (2020). Sinus Bradycardia. Life in the Fast Lane. Retrieved from https://litfl.com/sinus-bradycardia-ecg-library/

Explanation – Question 25

This patient has marked bradycardia on physical examination with a borderline low blood pressure. These vital sign abnormalities are likely the cause of the patient's dizziness. Bradycardia is defined as any heart rate under 60 beats/min. The most common cause of bradycardia is sinus bradycardia (Choice A). Other types of bradycardia include conduction blocks (i.e. type 2 or type 3 AV blocks), junctional rhythms (lack of P waves with slow SA nodal conduction), idioventricular rhythms (wide QRS complex rhythms that originate from the ventricles, not atria), or low atrial fibrillation or atrial flutter. About 80% of all bradycardias are caused by factors external to the cardiac conduction system, such as hypoxia, drug effects (i.e. beta blocker or calcium channel blocker use or overdose), or acute coronary syndromes.

Sinus bradycardia (Choice A) occurs when the electrical impulse originates from the SA node in the atria. Signs of sinus bradycardia on EKG are the presence of a P wave prior to every QRS complex. This EKG shows P waves prior to each QRS complex, but there are extra P waves that are not followed by QRS complexes. Some P waves are "buried" within QRS complexes or within T waves. The EKG below marks each P wave with a red arrow and each QRS complex with a blue arrow.



First-degree AV Block (Choice B) is a benign arrythmia characterized by a prolonged PR interval. This patient's EKG has variable PR intervals (some prolonged, some normal). This is a result of a more severe AV conduction block. Second-Degree AV Blocks are divided into Mobitz type I and Mobitz Type II. Mobitz type I, also known as Wenckebach, is characterized by a progressive lengthening PR interval followed by a dropped QRS complex. This can be remembered by the phrase, "longer, longer, longer, drop". Wenckebach is a benign arrythmia that does not typically require any treatment. Mobitz type II (Choice C) is characterized by a normal PR interval with random intermittent dropping of QRS complexes.

This patient's EKG has consistent spacing between each QRS complex (blue arrow) and consistent spacing between each P wave (red arrow). However, the P waves and QRS complexes are not associated with each other. This phenomenon is known as AV dissociation. These EKG changes are signs of a complete heart block, also known as Third-Degree AV Block (Choice D). Both Second-Degree AV block- Mobitz type II (Choice C) and Third-Degree AV Block **(Choice D)** are more serious conduction blocks that require cardiac pacemakers.

References

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Explanation – Question 26

This patient presents to the Emergency Department with palpitations, a narrow complex tachycardia (<120 msec), and an irregularly irregular rhythm. A close look at this patient's EKG reveals the absence of discrete P waves and QRS complexes that are spaced at varying distances from each other (most apparent in lead V6). These signs support a diagnosis of Atrial Fibrillation, or "AFib". AFib is an arrhythmia characterized by an irregularly irregular rhythm, the absence of P waves with a flat or undulating baseline, and narrow QRS complexes. Wide QRS complexes may be present in AFib if there is a concurrent bundle branch block or Wolff-Parkinson White Syndrome. AFib is caused by the electric firing of multiple ectopic foci in the atria of the heart. This condition is triggered by a multitude of causes, including ischemic heart disease, valvular heart disease, dilated or hypertrophic cardiomyopathies (likely related to this patient's congestive heart failure history), sepsis, hyperthyroidism, excess caffeine or alcohol intake, pulmonary embolism, and electrolyte abnormalities.

The main risk in AFib is the creation of thrombi in the atria as they fibrillate, resulting in emboli that travel to the brain and cause a stroke. The CHA2DS2VASc scoring system is used to risk stratify patients and determine if they require anticoagulation to prevent against thrombo-embolic phenomenon (i.e. stroke). This patient has a high CHA2DS2VASc score, so she would require anticoagulation. In addition to anticoagulation, AFib is treated with rate control (i.e. beta blockers or calcium channel blockers), rhythm control (i.e. anti-arrhythmic agents), or electrical cardioversion.

Electrical cardioversion (choice A) is typically avoided when symptoms occur greater than 48 hours, since the risk of thrombo-emboli formation is higher in this scenario. An exception to this would be a patient with "unstable" AFib. Signs of instability in any tachyarrhythmia are hypotension, altered mental status, or ischemic chest pain. This patient lacks all of these signs and symptoms. Although this patient lacks signs of instability, this patient's marked tachycardia should be addressed with medical treatment. General observation (Choice C) is not the best choice for this reason. Intravenous adenosine (Choice D) is the best choice for a patient with supraventricular tachycardia (SVT). This is a narrow-complex AV nodal re-entry tachycardia with rates that range from 120-280bpm. SVT also lacks discrete P waves. A key factor that differentiates AFib from SVT is that SVT has a regular rhythm, while AFib has an irregular rhythm. Intravenous metoprolol **(Choice B)** is the best treatment option listed in order to decrease the patient's heart rate.

References

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- Burns, E. (2020) Atrial Fibrillation. Life in The Fast Lane. Retrieved from https://litfl.com/atrial-fibrillation-ecg-library/

Explanation – Question 27

This patient has a narrow-complex, regular tachycardia that is causing the sensation of palpitations. The clinical history, rapid heart rate, and 12-lead EKG provide enough information to diagnose this patient with a supraventricular tachycardia, also known as "SVT". Supraventricular tachycardias refer to a broad range of arrythmias, including sinus tachycardia, atrial fibrillation, atrial flutter, multifocal atrial tachycardia, and AV nodal re-entry tachycardia. This scenario specifically depicts an AV nodal

re-entry tachycardia (AVNRT). AVNRT is a common type of SVT that can occur spontaneously or is triggered by sympathomimetic agents (i.e. cocaine, amphetamines), caffeine, alcohol, exercise, or beta-2 agonists using in asthma treatment (i.e. albuterol, salbutamol). AVNRTs are narrow-complex tachycardias with rates that range from 120-280 bpm. P waves are typically absent in AVNRTs, but rarely they may be present as retrograde inverted P waves located immediately before or after the QRS complex. Symptoms experienced by the AVNRT patient may include pre-syncope, syncope, dizziness, palpitations, anxiety, or mild shortness of breath. Patients with AVNRTs are more likely to be young and female over male.

QRS complexes in AVNRTs are often narrow (<120 msec), however, wide QRS complexes may be present in AVNRTs if there is a concurrent bundle branch block or Wolff-Parkinson White Syndrome. AVNRTs are often stable and do not require electric cardioversion. However, signs that indicate instability and necessitate synchronized cardioversion are hypotension (SBP <90mmHg), altered mental status, heart failure findings (e.g. crackles on lung auscultations), shock findings (e.g. delayed capillary refill time, cold and clammy skin, weak pulses) or ischemic chest pain (more common if known history of ischemic heart disease). This patient has hypotension, and this puts her into tha unstable category. Therefore, she requires synchronized cardioversion **(Choice A)**.

If the patient is stable, treatment of AVNRT focuses on restoring the patient to normal sinus rhythm which leads to resolution of symptoms. First-line medications for AVNRTs are short-acting AV nodal blocking agents, like adenosine. Beta blockers or calcium channel blockers act as second-line agents for patients who do not respond to adenosine. Metoprolol is a beta blocker (Choice C) and Diltiazem is a calcium channel clocker (Choice D). Prior to any medications, vagal maneuvers (Choice B) should always be attempted first in a stable patient with AVNRT. The Valsalva maneuver, or "bearing down", is a commonly used vagal maneuver in the termination of stable AVNRTs. Other vagal maneuvers include the carotid massage or the Diving reflex (place bag of ice and water on face).

References

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- Burns, E. (2020). Supraventricular Tachycardia (SVT). Life in the Fast Lane. Retrieved from https://litfl.com/supraventricular-tachycardia-svt-ecg-library/

Explanation – Question 28

This patient presents to the Emergency Department with vague and nonspecific symptoms of nausea, fatigue, and palpitations. The initial EKG (EKG #1) demonstrates a wide-complex tachycardia (QRS >120msec) with a regular rhythm. The differential diagnosis for wide-complex tachyarrhythmias include ventricular tachycardia (monomorphic ventricular tachycardia), torsades de pointes (polymorphic ventricular tachycardia), coarse ventricular fibrillation, supraventricular tachycardias with aberrancy (i.e. underlying Wolf Parkinson White Syndrome or Ventricular Bundle Branch Block), electrolyte abnormalities (i.e. Hyperkalemia), and from medications (i.e. Na channel blocking agents). If the history is unclear or the patient shows signs of instability, Ventricular tachycardia should always be the assumed tachyarrhythmia. This is managed with electrical cardioversion or with medications (i.e. amiodarone, procainamide, lidocaine), depending on the patient's symptoms and hemodynamic stability.

The prior EKG for the patient (EKG #2) is helpful in showing that the patient does not have a wide QRS complex at baseline. There also are no EKG signs of Wolf Parkinson White Syndrome (Choice B) on EKG #2, making this choice incorrect. Signs of this cardiac pre-excitation syndrome on EKG include a shortened PR interval and a delta wave (slurred upstroke at the beginning of the QRS complex). Anxiety (Choice D) can cause sinus tachycardia and be a symptom associated with any arrhythmia, but it is not the underlying cause for this patient's bizarre wide-complex tachydysrhythmia.

On a closer look, the patient's EKG (EKG #1) demonstrates tall, peaked T waves in the precordial leads. This supports a diagnosis of hyperkalemia. Other signs of hyperkalemia on EKG include flattened or absent P waves, widened QRS complexes, or a sine wave morphology. A common underlying cause of hyperkalemia is renal disease **(Choice C)**.

Ischemic heart disease (Choice A) is a common underlying cause for ventricular tachycardia. Ventricular tachycardia is less likely in this case given the presence of peaked T waves and the lack of fusion beats, capture beats, or signs of AV dissociation on the 12-lead EKG.

References

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Explanation – Question 29

This patient presents to the Emergency Department with seven days of severe vomiting, diarrhea, tachycardia, and borderline hypotension. The clinician should be concerned about dehydration and potential electrolyte derangements induced by the vomiting and diarrhea. Certain electrolyte derangements can put a patient at risk for cardiac dysrhythmias, so ordering a 12-lead EKG is an important step in evaluating any patient with a potential electrolyte disturbance. Dangerous electrolyte disturbances that can predispose a patient to cardiac dysrhythmias include hyperkalemia, hypokalemia, hypomagnesemia, and hypocalcemia. Signs of hyperkalemia on the EKG include peaked T waves, absent or flattened P waves, widened QRS complexes, or a sine wave morphology. Low potassium, magnesium, and calcium can all prolong the QT interval and predispose the patient to polymorphic ventricular tachycardia (Torsades de Pointes). Hypokalemia on EKG may also be associated with a U wave, which is an upward wave that follows the T wave.

This patient's 12-lead EKG shows a wide-complex tachycardia with QRS complex "twisting" around the isoelectric line and varying QRS amplitudes. These EKG signs, along with the inferred history of severe electrolyte abnormalities, suggest a diagnosis of Torsades de Pointes (TdP). Another risk factor for TdP is a history of congenital prolonged QT syndromes. Similar to monomorphic ventricular tachycardia, TdP should always be treated with electrical cardioversion if there are any signs of instability (i.e. altered mental status, SBP <90mmHg). A pulseless patient with TdP always necessitates unsynchronized cardioversion, also known as defibrillation.

This patient may have briefly syncopized or potentially underwent cardiac arrest. Intravenous Amiodarone (Choice A) and Procainamide (Choice B) are contraindicated in TdP as both of these agents can further prolong the QT interval. These agents can be used in a stable patient with monomorphic ventricular tachycardia. Intravenous Ciprofloxacin (Choice C) is a quinolone antibiotic that is useful for treating infections from gram negative bacteria. This may be beneficial for this patient, especially if there is concern for bacterial gastroenteritis. However, quinolone antibiotics also can prolong the QT interval, and this medication will not acutely stabilize this patient. Intravenous Magnesium Sulfate **(Choice D)** shortens the QT interval and is the preferred therapy for a TdP patient with a pulse.

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Explanation – Question 30

This patient arrives at the Emergency Department with return of spontaneous circulation (ROSC) from a ventricular fibrillation cardiac arrest. His regaining of pulses was likely due to his limited downtime, prompt initiation of CPR, and prompt diagnosis and treatment of ventricular fibrillation with electrical defibrillation. Important elements of emergency post-ROSC care include avoiding hypotension, hypoxia, hyperthermia, and hypo or hyperglycemia. Maintaining proper perfusion to the brain and peripheral organs is crucial in all ROSC patients. A 12-lead EKG should always be obtained early after ROSC is achieved in order to look for signs of cardiac ischemia. Cardiac catheterization should be considered in all post-ROSC patients, especially those with cardiac arrest from ventricular fibrillation or ventricular tachycardia.

Patients who achieve ROSC can vary markedly in terms of their clinical exam. Some patients may be awake and conversive, while others are comatose and non-responsive. The neurological exam immediately post-ROSC does not predict long-term outcomes, so decisions on prognosis should not be based on these factors in the Emergency Department. For this reason, resuscitation efforts should not be considered medically futile in this scenario (Choice A). Vasopressors (Choice B) are medications useful for post-ROSC patients with signs of hemodynamic collapse, such as hypotension. This patient is not hypotensive and does not meet the criteria for initiation of vasopressors. A CT scan of the head (Choice D) is a study to consider in any patient who presents to the Emergency Department with collapse to evaluate for intracranial bleeding (i.e. Subarachnoid bleeding). Although not impossible, the history of chest pain prior to collapse makes brain bleeding a less likely cause of death in this patient. Targeted Temperature Management **(Choice C)**, also known as Therapeutic Hypothermia, is the best next step in this patient's management.

Targeted Temperature Management involves a controlled lowering of the patient's body temperature to 32-34°C in the first 24 hours after cardiac arrest. This treatment has been shown to improve neurologic and survival outcomes. The theory behind this treatment is that hypothermia post-ROSC

reduces free radical damage and decreases cerebral metabolism. Data behind targeted temperature management shows the greatest benefit in patients with cardiac arrest due to ventricular fibrillation, but arrest from ventricular tachycardia, pulseless electrical activity, and asystole may also show benefit. Adverse effects of this treatment include coagulopathy, bradycardia, electrolyte abnormalities (i.e. hypokalemia), and shivering. Important contraindications to this treatment are an awake or alert patient (post-ROSC GCS >6), DNR or DNI status, another reason to explain comatose state (i.e. intracranial bleeding, spinal cord injury), age under 17 years-old, a poor functional status prior to the cardiac arrest (i.e. nonverbal, bedbound), or an arrest caused by trauma.

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Video-based and simulation-based training is associated with better learning outcomes when compared with traditional didactic lectures only. Video-based, low-fidelity, and high-fidelity simulation training yield equivalent outcomes.

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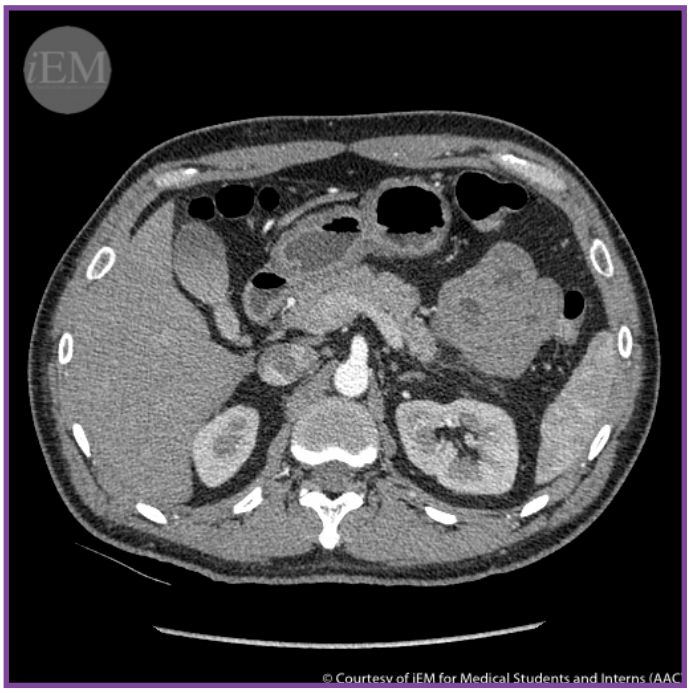
Question 31

A 76-year-old woman presents to the Emergency department complaining of acute onset diffuse abdominal pain that began 10 hours ago. The pain is constant and associated with non-bloody vomiting and loose bowel movements. The patient's medical history includes hypertension, diabetes, atrial fibrillation, and coronary artery disease. The patient has no prior surgical history. On examination, her temperature is 37°C, blood pressure 150/90 mmHg, pulse 108 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The patient appears in significant pain, but her abdomen is soft and mildly tender on physical examination. A CT scan of the abdomen and pelvis is ordered for further evaluation. An image from this scan is on the right.



Which of the following is the most likely diagnosis causing this patient's symptoms?

A Ruptured appendicitis

B Ruptured abdominal aortic aneurysm

C Mesenteric ischemia

D Ureterolithiasis

Question 32

A 52-year-old male presents to the Emergency Department complaining of sharp epigastric abdominal pain for two days. The pain is intermittent, radiates to the mid-thoracic area, and is associated with non-bloody vomiting. The patient's medical history includes hypertension, diabetes, alcohol abuse, and hypothyroidism. The patient has a history of a prior cholecystectomy. On examination, his temperature is 37°C, blood pressure 140/90 mmHg, pulse 115 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The patient is vomiting at the bedside, appears in pain, and lacks any tremors or tongue fasciculations. The abdomen is soft with tenderness and mild guarding to the epigastrium. Laboratory tests for this patient are in the table below.

Test	Test Result	Reference Range
BUN	23	6-20 mg/dL
Creatinine	1.02	0.80-1.21 mg/dL
ALT	100	4-36 U/L
AST	220	8-33 U/L
Lipase	5,300	0-160 U/L
Albumin	3.2	3.4-5.4 g/L

Which of the following is the most appropriate next step in management for this patient's condition?

A IV midazolam

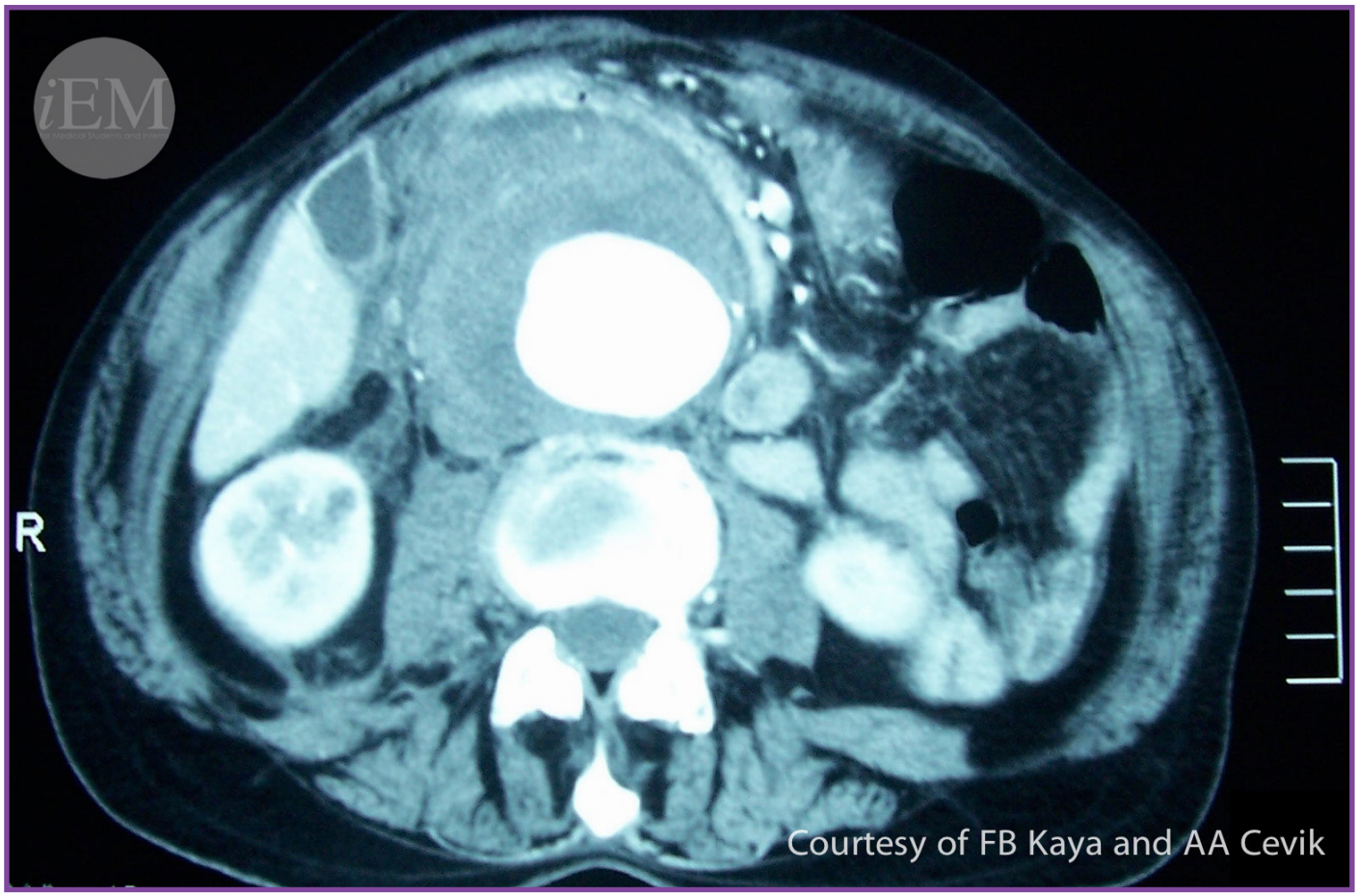
B CT scan of abdomen/pelvis

C Surgery consultation

D IV hydration

Question 33

A 71-year-old male tobacco smoker presents to the Emergency Department complaining of diffuse abdominal pain and generalized weakness for one day. The patient's medical history includes hypertension and diabetes. He lacks any prior abdominal surgical history. On examination, his temperature is 37°C, blood pressure 88/40 mmHg, pulse 108 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 97% on room air. The patient has a brief syncopal episode while you perform the physical examination. A STAT CT scan is completed and is shown below.



Which of the following is the most appropriate next step in management for this patient's condition?

A Surgical consultation

B IV Vancomycin and Piperacillin-Tazobactam

C Endotracheal intubation

D IV Heparin

Question 34

A 22-year-old female presents to the Emergency Department complaining of 2 days of worsening constant right lower abdominal pain with poor appetite. She is 10 weeks pregnant and G1P0. She denies dysuria, hematuria, fevers, vomiting, vaginal bleeding, or vaginal discharge. The patient has no prior medical or surgical history. On examination, her temperature is 37°C, blood pressure 98/60 mmHg, pulse 94 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft but with marked tenderness and guarding in the right lower quadrant. Bimanual pelvic exam is unremarkable. Transvaginal ultrasound shows a single intrauterine pregnancy and no ovarian pathology.

Which of the following is the most appropriate next step in management for this patient's condition?

A CT scan of abdomen/pelvis with IV contrast

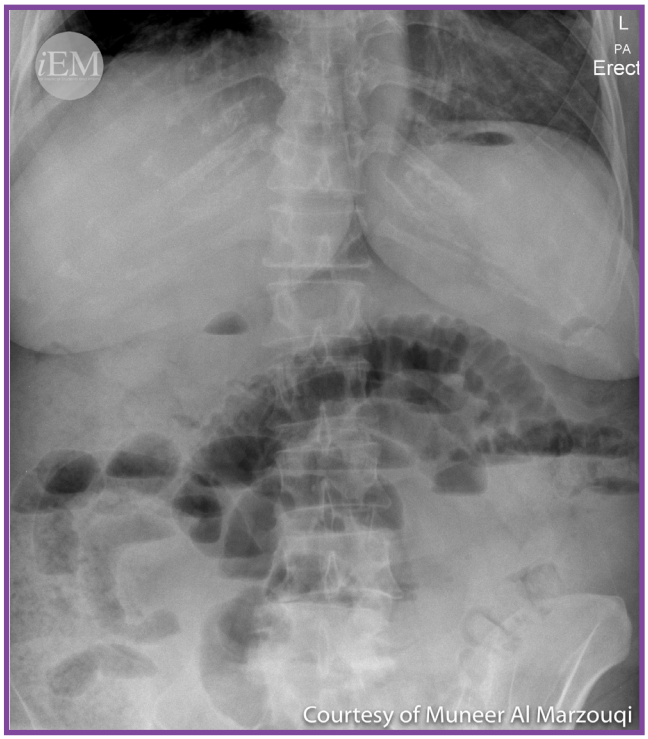
B Ultrasound of the appendix

C MRI of abdomen/pelvis

D IV Piperacillin-Tazobactam

Question 35

A 62-year-old female presents to the Emergency Department complaining of 3 days of intermittent diffuse abdominal crampy pain with nausea and vomiting. The patient has not had a bowel movement in 2 days. The patient's history includes hypertension and diabetes. Surgical history includes a prior cholecystectomy, appendectomy, and hysterectomy for uterine fibroids. On examination, her temperature is 37°C, blood pressure 110/70 mmHg, pulse 112 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. Glucose level is 205 mg/dL (normal non-fasting range 70-140mg/dL). The abdomen is soft, distended, and diffusely tender. An upright abdominal X-ray is performed and shown on the right.



Which of the following is the most likely cause of this patient's condition?

A Malignancy

B Adhesions

C Diabetic ketoacidosis

D Delayed gastric emptying

Question 36

A 53-year-old male presents to the Emergency Department complaining of 4 days of worsening right lower abdominal pain. The patient has had nausea, vomiting, and constipation for two days. The patient's history includes hypertension, diabetes, and no prior surgical history. On examination, his temperature is 37°C, blood pressure 92/50 mmHg, pulse 118 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft and mildly distended. There is a firm bulge over the inguinal crease in the right groin area. Palpation of the area yields focal tenderness, guarding, and overlying skin redness. The bulge protrudes with coughing. There is no testicular redness, tenderness, or subcutaneous crepitus noted.

Which of the following is the most likely diagnosis of this patient's condition?

A Incarcerated inguinal hernia

B Strangulated Spigelian hernia

C Fournier's gangrene

D Strangulated inguinal hernia

Question 37

A 85-year-old male presents to the Emergency Department complaining of 2 days of generalized abdominal pain and distension. The patient's history includes advanced dementia, chronic constipation, hypertension, diabetes, and no prior surgical history. On examination, his temperature is 37°C, blood pressure 150/90 mmHg, pulse 98 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft, distended, and diffusely tender. An abdominal X-ray is performed, and the image is below.

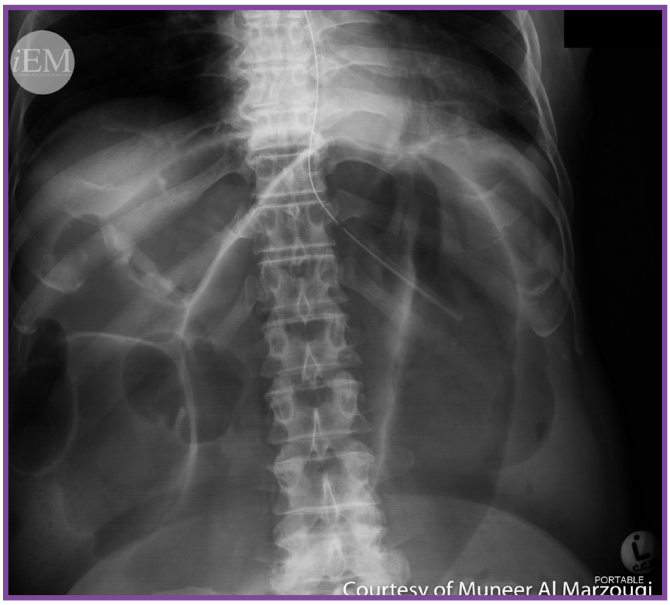
Which of the following is the most appropriate next step in management for this patient?

A CT scan of the abdomen and pelvis

B Emergent surgical consultation for colectomy

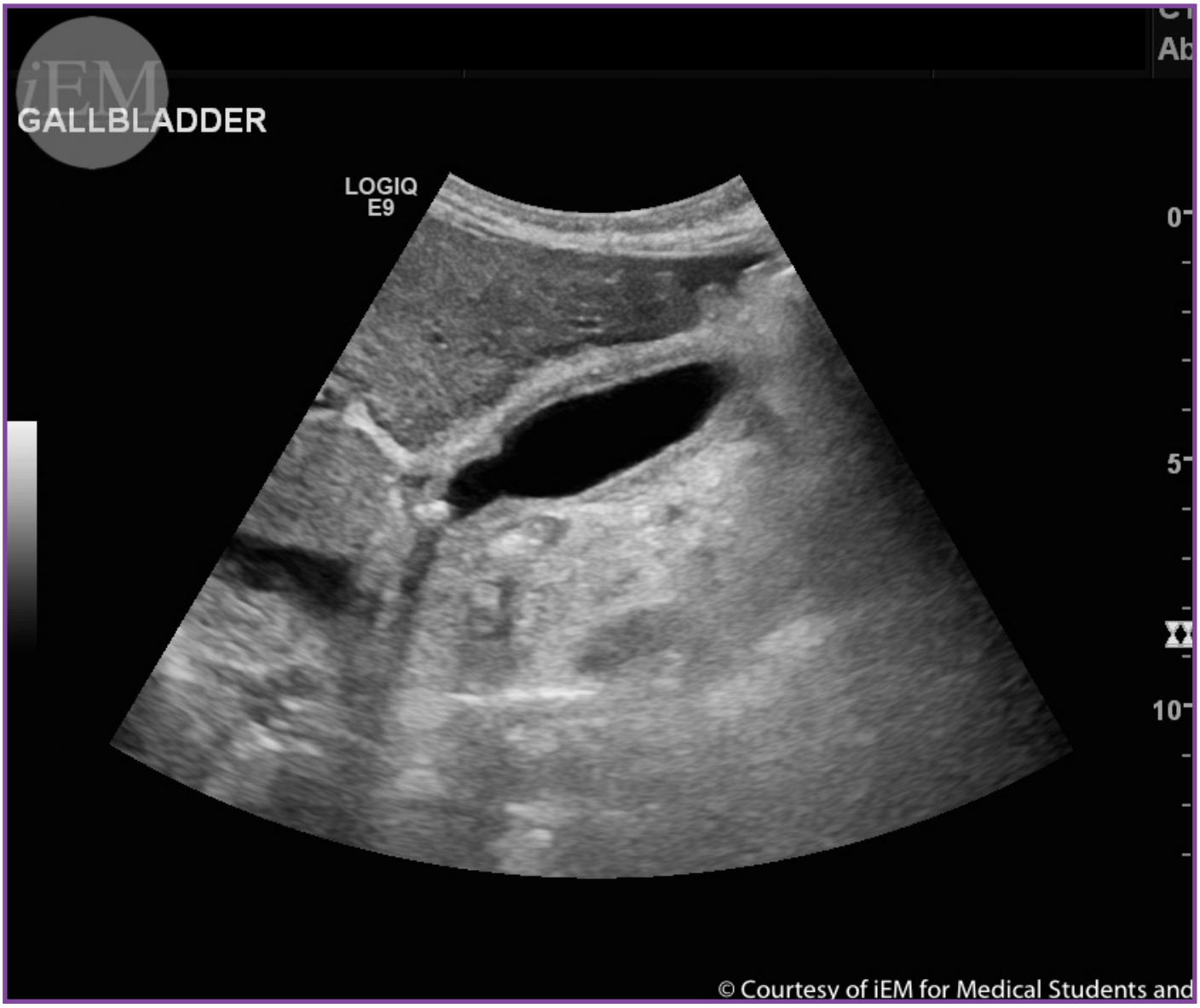
C Emergent surgical consultation for detorsion

D IV Ciprofloxacin and IV Metronidazole



Question 38

An obese 38-year-old female presents to the Emergency Department complaining of 1 day of intermittent upper abdominal pain with nausea and vomiting. The patient denies any past medical or surgical history. On physical examination, her temperature is 38°C, blood pressure 130/80 mmHg, pulse 112 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft, non-distended, and focally tender in the right upper quadrant. An abdominal ultrasound is performed, and an image from the exam is shown below.



Which of the following is the most likely cause for this patient's condition?

A. Biliary colic

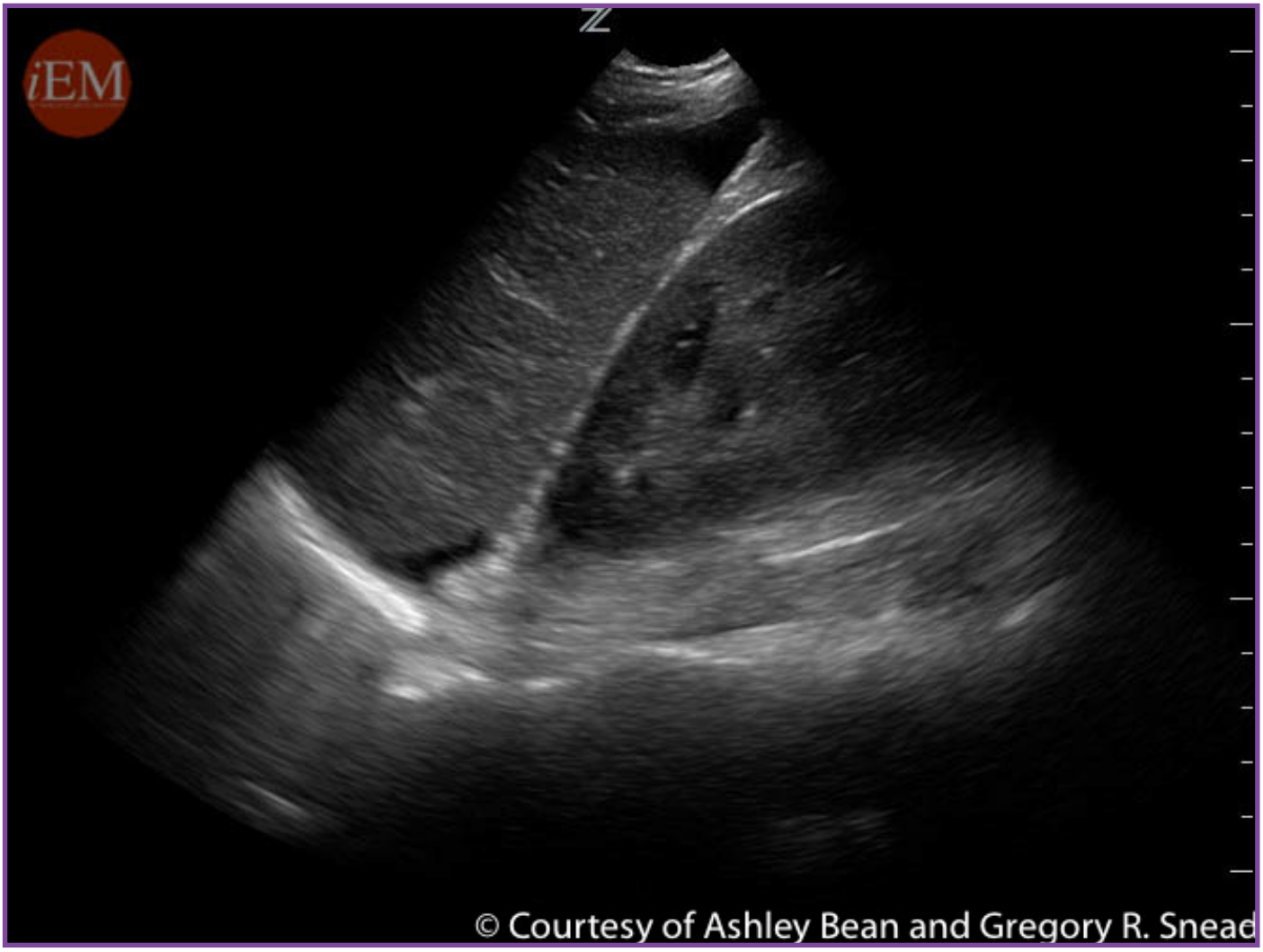
B. Acute cholecystitis

C. Gastritis

D. Pancreatitis

Question 39

A 25-year-old female presents to the Emergency Department complaining of atraumatic right shoulder pain, vaginal bleeding and generalized abdominal discomfort. She denies nausea, vomiting, fevers, or chest pain. The patient has no past medical or surgical history. On examination, her temperature is 37°C, blood pressure 88/40 mmHg, pulse 125 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The abdomen is soft with generalized tenderness. A routine urine pregnancy test is performed and positive. A bedside FAST exam is completed and is shown below.



Which of the following is the most appropriate next step in management for this patient?

A IM Methotrexate

B Shoulder X-ray

C Obstetrics/Gynecology consultation

D IM Rho(D) immune globulin (RhoGAM)

Question 40

A 81-year-old female presents to the Emergency Department complaining of constipation, anorexia, and lower left abdominal pain. She denies blood in stool, vomiting, or dysuria. Her medical history includes diabetes, hypertension, and breast cancer in remission. She has no prior abdominal surgeries. On examination, her temperature is 38°C, blood pressure 160/95 mmHg, pulse 110 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The abdomen is soft with marked tenderness in the left lower quadrant. Acetaminophen and IV normal saline are administered to the patient.

Which of the following is the most appropriate next step in management for this patient's condition?

A IV Vancomycin

B CT scan of the abdomen and pelvis

C Gastroenterology consultation for emergent colonoscopy

D IV Metronidazole and Ciprofloxacin

Diagnostic Machine Learning Models for Acute Abdominal Pain: Towards an e-Learning Tool for Medical Students.

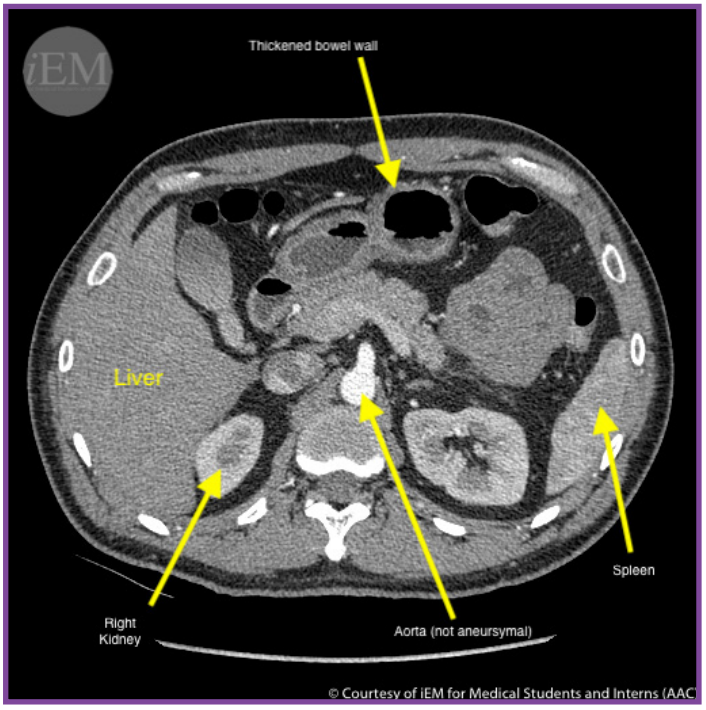
Computer-aided learning systems (e-learning systems) can help medical students gain more experience with diagnostic reasoning and decision making.

Khumrin P, Ryan A, Judd T, Verspoor K. Diagnostic Machine Learning Models for Acute Abdominal Pain: Towards an e-Learning Tool for Medical Students. Stud Health Technol Inform. 2017;245:447-451. PMID: 29295134.

Explanation – Question 31

This elderly female patient presents to the Emergency Department with acute onset of severe abdominal pain, vomiting, and diarrhea. Compared to younger patients, abdominal pain in an elderly patient has a higher likelihood of being due to a surgical emergency or from a diagnosis that carries a higher mortality. Elderly patients may have more nonspecific associated symptoms that may make it difficult to confirm a dangerous diagnosis without advanced imaging. Additionally, elderly patients do not always have a fever or elevated white blood cells during an abdominal infection. The differential diagnosis of abdominal pain in an elderly patient should be broad and encompass conditions related to many body systems. The patient in this question has pain that is reported as being significantly high in relation to the minimal amount of abdominal tenderness provoked by the physical exam. This finding, known as "pain out of proportion" should raise concern for an ischemic etiology of the patient's pain.

Ruptured appendicitis (Choice A) is less likely as the patient lacks clinical signs of peritonitis (i.e. diffuse tenderness with guarding, fever, hypotension, signs of shock). Appendicitis, although not impossible in an elderly individual, is a diagnosis that occurs more often in younger patients.Ruptured abdominal aortic aneurysm (Choice B) typically results in death rapidly from hemorrhagic shock. This patient lacks signs of shock (hypotension, tachycardia, altered mental status), and her aorta on CT scan is not enlarged or aneurysmal (see image below).



Ureterolithiasis (Choice D), or a stone in the ureter, typically manifests as unilateral intermittent flank pain with hematuria. The question stem does not report a history of prior stones, and a first-time stone at an elderly age is not likely. Given the patent's advanced age, her "pain out of proportion", acute onset, risk factors for thromboembolic disease (Atrial fibrillation), the most likely diagnosis is acute mesenteric ischemia **(Choice C)**. X-ray imaging can be used prior to CT angiogram imaging, but CT imaging is more specific and sensitive in making the diagnosis. X-ray imaging may show bowel dilation, ileus, or pneumatosis intestinalis (air in bowel wall) in severe cases. Lactate and D-Dimer testing can be used in the evaluation of these patients, but neither test is specific for mesenteric ischemia and reliable enough to rule out the disease.

CT angiogram imaging of the abdomen and pelvis is the gold-standard diagnostic test for mesenteric ischemia. Early CT findings include bowel wall thickening (seen on this patient's imaging), dilated bowel, mesenteric edema, or ascites. Late CT findings include pneumoperitoneum, portal venous gas, and pneumatosis intestinalis. Treatment of acute mesenteric ischemia is fluid resuscitation, broad spectrum antibiotics, surgical consultation, and consideration for anticoagulation.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.

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Explanation – Question 32

This patient has intermittent epigastric abdominal pain with nausea and vomiting that radiates to the back. He has a history of alcohol abuse, but lacks tremors or tongue fasciculations to demonstrate signs of active alcohol withdrawal. Laboratory testing reveals pre-renal acute kidney injury (BUN/Creatinine ratio >20), elevated liver function tests with a hepatocellular pattern (AST>ALT in 2:1 ratio), and a markedly elevated lipase. This information supports a diagnosis of acute pancreatitis. Administration of IV midazolam, a benzodiazepine, would be an appropriate next step if the patient had signs or symptoms of alcohol withdrawal. Alcohol withdrawal can begin as early as 6 hours after refraining from alcohol intake in a chronic alcohol user. Information regarding alcohol intake is not provided in the question, but objective clinical signs indicating withdrawal are not present on physical examination. Ordering a CT scan of the abdomen and pelvis (Choice B) is not required in making the diagnosis of acute pancreatitis. A CT scan can be helpful if you are considering an alternative diagnosis (i.e. AAA, abdominal abscess, etc) or if there is a concern for sepsis or fulminant pancreatitis.

Diagnosis of pancreatitis is made clinically based on the history and physical exam, risk factors for the disease, and laboratory testing. Pancreatitis typically presents as upper abdominal pain that radiates to the flanks and back. Nausea and vomiting are frequent accompanying symptoms. The disease can range from mild symptoms to severe symptoms with pancreatic necrosis, multi-organ failure, shock, and Acute Respiratory Distress Syndrome (ARDS). Serum lipase testing is more specific than amylase for pancreatitis. Lipase is elevated in pancreatitis. Risk factors for the disease include gallstones, alcohol use, abdominal trauma, recent ERCP, hypertriglyceridemia, pancreatic ischemia, scorpion envenomation, certain viral infections (Mumps, CMV), hypercalcemia, and certain medications (sulfonamides, azathioprine, valproic acid, etc). The most common cause of first-time pancreatitis is gallstones. A gallbladder ultrasound should always be performed in patients with a gallbladder who present with pancreatitis. A surgical consultation (Choice C) for gallbladder removal would be warranted if this patient had gallstone pancreatitis, but the patient has a history of a cholecystectomy. The likely cause of this patient's pancreatitis is his alcohol abuse which causes direct pancreatic injury and inflammation.

Treatment of pancreatitis includes IV hydration **(Choice D)**, analgesia, antiemetics, and monitoring for electrolyte abnormalities. Avoiding food or liquid intake (NPO) for "pancreatic rest" has been recommended historically for all cases of pancreatitis, however there is not robust evidence to support this practice. Routine antibiotics are not recommended for acute pancreatitis, unless there are signs of sepsis.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
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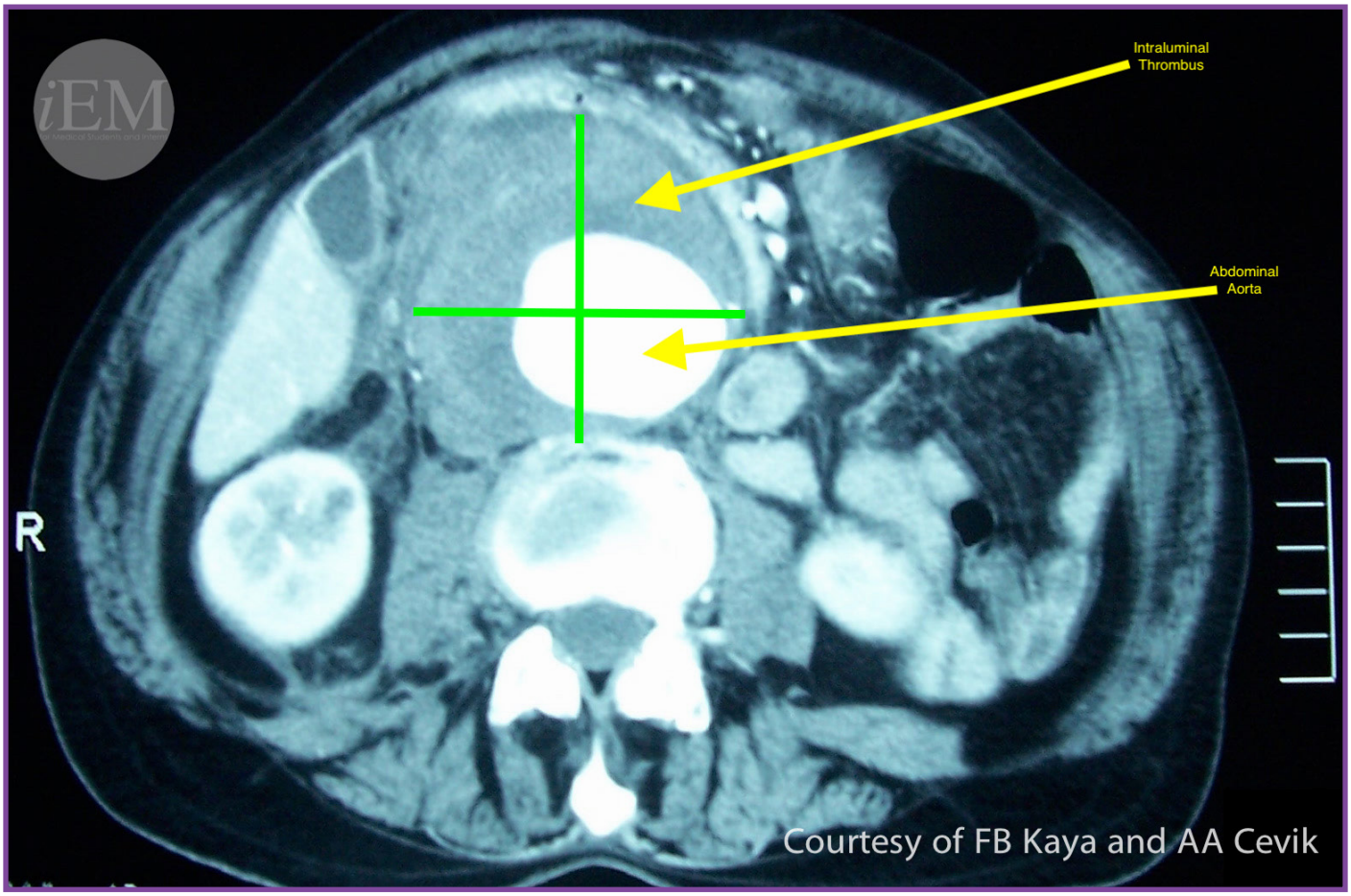
Explanation – Question 33

This elderly male patient presents to the Emergency Department with abdominal pain. Compared to younger patients, abdominal pain in an elderly patient has a higher likelihood of being due to a surgical emergency or from a diagnosis that carries a higher mortality. Elderly patients may have more nonspecific associated symptoms that may make it difficult to confirm a dangerous diagnosis without advanced imaging. Additionally, elderly patients do not always have a fever or elevated white blood cells during an abdominal infection. The differential diagnosis of abdominal pain in an elderly patient should be broad and encompass conditions related to many body systems.

The syncopal event and signs of shock should raise concern for a more serious etiology of the patient's symptoms. The CT image provided shows a dilated aorta filled with contrast dye and a large surrounding intra-luminal thrombus. An infrarenal abdominal aorta measuring over 3 cm is considered aneurysmal. This patient's abdominal aorta measures approximately 7 cm from outer wall to outer wall using the scale provided on the right-hand side of the image. The green measurement line in the image below shows the size of the aorta from the outer wall to the outer wall (including the thrombus).



The diagnosis for this patient is a ruptured abdominal aortic aneurysm (AAA). This condition carries a high mortality and is often lethal without prompt surgical intervention **(Choice A)**. Administration of blood products is helpful if there are signs of hemorrhagic shock as in this patient. Antibiotics, like IV Vancomycin and Piperacillin-Tazobactam (Choice B), are not helpful in the management of this diagnosis. Endotracheal intubation (Choice C) is needed prior to operative intervention, but Emergency Department management should focus on volume resuscitation and close communication with the surgical team for operative repair. IV Heparin (Choice D) may be beneficial in acute mesenteric ischemia from an embolic etiology (i.e. Atrial fibrillation), but anticoagulation would worsen this patient's hemorrhagic shock.

AAAs can present to the Emergency Department without any symptoms and be discovered incidentally on imaging or on physical exam as a pulsatile abdominal mass. Other presentations include severe back pain (the abdominal aorta is retroperitoneal) and circulatory shock. Rupture of a AAA can be large and result in rapid decompensation and death, or bleeding can be contained in the retroperitoneal space with transiently stable vital signs. Risk factors for AAA formation are male sex, tobacco use, hypertension, increased patient age, Marfan syndrome, or Ehlers-Danlos syndrome. The diagnosis of AAA is clinical and includes the use of bedside aortic ultrasound or CT aortic angiogram imaging. Treatment for AAA depends on aortic size and patient symptoms. Operative repair is indicated for any AAA over 5.5 cm diameter in men, over 5.0cm diameter in women, or any size if there are signs of shock or concern for AAA rupture.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
- Nickson, C. (2020). Abdominal aortic aneurysm (AAA). Life in the Fast Lane. Retrieved from https://litfl.com/abdominal-aortic-aneurysm-aaa/

Explanation – Question 34

This patient is pregnant in the first trimester and presenting to the Emergency Department with right lower quadrant pain. Any first-trimester pregnant patient with abdominal pain should be evaluated for ectopic pregnancy. Other causes of this symptom include ovarian torsion, ovarian cyst rupture, pelvic inflammatory disease, tubo-ovarian abscess, urinary tract infection, ureterolithiasis, colitis, or appendicitis. An intra-uterine pregnancy is confirmed on transvaginal ultrasound, which excludes ectopic pregnancy from the differential. Ovarian pathologies are also investigated on the ultrasound and are not discovered.

Another common diagnosis based on the patient's pain location, young age, and markedly tender abdomen is acute appendicitis. The most common presenting symptom in appendicitis is right lower quadrant pain. Other signs include fever, anorexia, nausea, or vomiting. Pregnant women may present with back or flank pain, rather than right lower quadrant pain, as the uterus may displace the appendix in the abdomen. There is no single symptom or laboratory test that can reliably exclude the diagnosis of appendicitis. The gold standard test for acute appendicitis diagnosis is a CT scan of the abdomen with IV contrast dye. PO or PR contrast are additionally used in some institutions based on preference and protocols. In children, appendiceal ultrasound is performed first to avoid excessive radiation exposure and financial cost. CT scanning (Choice A) is similarly avoided in first-trimester pregnancy to diagnose appendicitis, although it is the test of choice in non-pregnant adults. MRI imaging of the abdomen and pelvis (Choice C) is another diagnostic option for pregnant patients, but this is not recommended until an ultrasound is performed. IV antibiotics (Choice D) may be needed to treat appendicitis or other abdominal infections, but this patient lacks a definitive diagnosis or signs of sepsis or shock, which would support emergent antibiotics. The best next step to further evaluate the cause of this patient's symptoms is conducting an appendiceal ultrasound **(Choice B)**. If this study is non-conclusive or is not available, an MRI should be performed. Emergency Department treatment for acute appendicitis is IV antibiotics, IV hydration, and surgical consultation for appendectomy. Immediate surgery may be avoided in patients who present several days after symptom onset or with a ruptured appendix. These cases are treated with IV antibiotics, IV hydration, bowel rest, and close monitoring.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
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Explanation – Question 35

This patient presents to the Emergency Department with generalized abdominal pain, nausea, vomiting, and constipation. The physical exam demonstrates tachycardia and a distended and diffusely tender abdomen. The patient has three prior abdominal surgeries. The upright abdominal X-ray shows multiple dilated loops of small bowel with air-fluid levels. The information provided by the history, physical exam, and diagnostic imaging collectively supports a diagnosis of small bowel obstruction. Small bowel obstruction (SBO) is a mechanical blockage to forward flow through the intestines. The majority of SBOs are caused by post-operative scar tissue formation (adhesions), but other causes include hernias, intra-abdominal malignancies, foreign bodies, and Crohn's disease. Symptoms include intermittent colicky abdominal pain, abdominal distension, nausea and vomiting, and constipation. Some patients may be able to pass stool and flatus early in the timeline of an SBO or if the obstruction is partial, rather than complete.

Typical exam findings in SBO are a diffusely tender abdomen and high-pitched bowel sounds. Findings of abdominal rigidity, guarding, or fever should raise concern about possible intestinal perforation, peritonitis, or intestinal necrosis. Diagnosis is made clinically in combination with diagnostic imaging, such as abdominal X-rays, CT scanning, or ultrasound. CT scans have better sensitivity and specificity in diagnosing an SBO than Xray. Abdominal ultrasound is more sensitive and specific in diagnosing SBO than CT scan, but this test requires a skilled practitioner to get high-quality results. Treatment of SBO involves IV hydration, surgical consultation for possible operative intervention, pain medications, antiemetics, and electrolyte repletion. Nasogastric tube placement for gastric decompression is helpful in patients who have marked abdominal distension, intractable vomiting, or have risks for aspiration (i.e. altered mental status).

The most common cause of SBO is adhesions **(Choice B)**, not malignancy (Choice A). Diabetic ketoacidosis (Choice C) can present with abdominal pain, nausea, and vomiting. However, DKA becomes more likely when the glucose is elevated over 250mg/dL. The presence of air-fluid levels and dilated small bowel on X-ray imaging also supports SBO over DKA. Delayed gastric emptying (Choice D) is the cause of gastroparesis, a diagnosis that can also present as nausea and vomiting. The other signs, symptoms, and imaging results make SBO a more likely diagnosis than gastroparesis.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
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Explanation – Question 36

A hernia is an abnormal defect in the abdominal wall through which intra-abdominal contents (i.e. bowel) can protrude. About 10% of the population experiences hernias at one time during their lifetime. Hernias can cause symptoms that range from mild discomfort to severe pain with signs of bowel obstruction, perforation, necrosis, or peritonitis. The most common type of hernia is the inguinal hernia located along the inguinal crease. Other types of hernias include the femoral hernia, obturator hernia, Richter hernia, internal hernias, and ventral hernias (umbilical, incisional, spigelian hernia types). Hernias are further classified as reducible, incarcerated (firm, painful, nonreducible), or strangulated (firm, severely painful, nonreducible, overlying skin redness or crepitus, signs of bowel necrosis or obstruction).

This patient has a right inguinal hernia on exam with overlying skin redness, severe tenderness, and signs of intestinal obstruction (vomiting, constipation, abdominal distension). This should raise concern over a strangulated hernia, which is a surgical emergency. Treatment includes IV hydration, IV antibiotics, and prompt surgical consultation for operative management. The patient's inguinal hernia is not incarcerated (Choice A), the hernia is strangulated. A Spigelian hernia (Choice B) is located along the lateral ventral abdomen along the rectus abdominal muscle. Spigelian hernias have a high rate of incarceration compared to other hernias. This patient's hernia is located along the inguinal crease, not the ventral abdominal wall. Fournier's gangrene is a severe necrotizing fasciitis of the perineum. Although early Fournier's gangrene may lack subcutaneous emphysema and marked skin redness, the location and other historical details make a strangulated inguinal hernia a more likely diagnosis. **Choice D** is the correct answer.

References:

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
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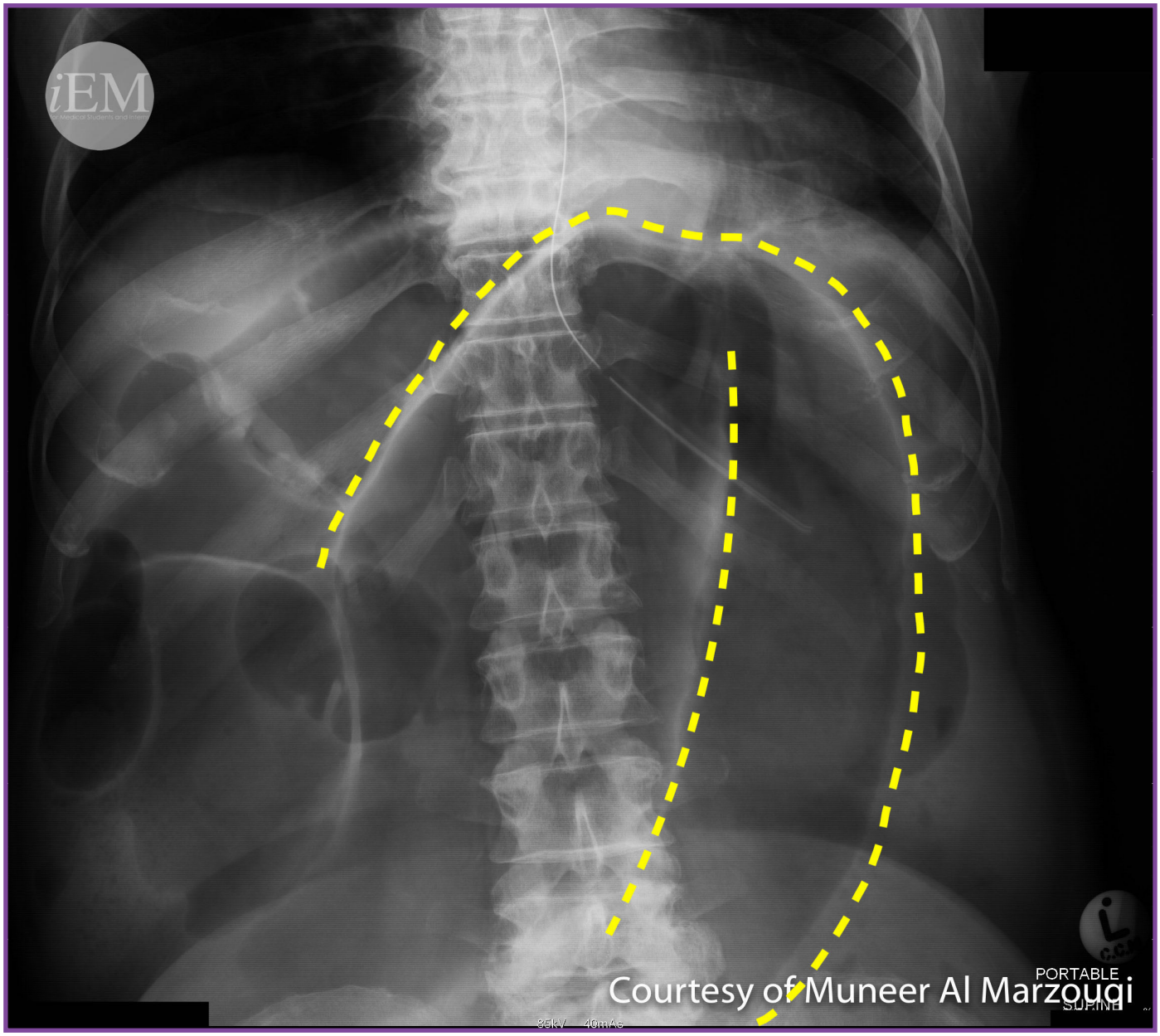
Explanation – Question 37

This elderly male patient presents to the Emergency Department with generalized abdominal pain and distension. Compared to younger patients, abdominal pain in an elderly patient has a higher likelihood of being due to a surgical emergency or from a diagnosis that carries a higher mortality. Elderly patients may have more nonspecific associated symptoms that may make it difficult to confirm a dangerous diagnosis without advanced imaging. Additionally, elderly patients do not always have a fever or elevated white blood cells during an abdominal infection. The differential diagnosis of abdominal pain in an elderly patient should be broad and encompass conditions related to many body systems.

The abdominal X-ray demonstrates a "coffee bean sign" and dilated loops of the large bowel (note haustra of large bowel). The image supports the diagnosis of a sigmoid volvulus, a type of large bowel obstruction that necessitates prompt surgical consultation in the Emergency Department. Risk factors for sigmoid volvulus are elderly age, constipation, poor mobility, and residence in a long-term care facility. If left untreated, volvulus can result in intestinal ischemia, necrosis, perforation, and peritonitis.



Sigmoid volvulus is often treated with manual intestinal detorsion through flexible sigmoidoscopy or rectal tube. Cecal volvulus is more common in younger patients, and requires surgical bowel resection or cecopexy (fixing the cecum to abdominal wall). The abdominal X-ray provided is sufficient to make the diagnosis of volvulus. A CT scan of the abdomen and pelvis (Choice A) is not necessary in this patient. Surgical consultation is the next best step. IV antibiotics (Choice D) are indicated in volvulus if there are signs of intestinal perforation, necrosis, or peritonitis. The question stem indicates that although the abdomen is tender and distended, the abdomen is soft. This makes peritonitis and the need for antibiotics less likely. Surgical consultation for colectomy (Choice B) would be correct if the patient had cecal volvulus or if there were signs of bowel necrosis. Surgical consultation for bowel detorsion **(Choice C)** is the best next step for this patient with sigmoid volvulus.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
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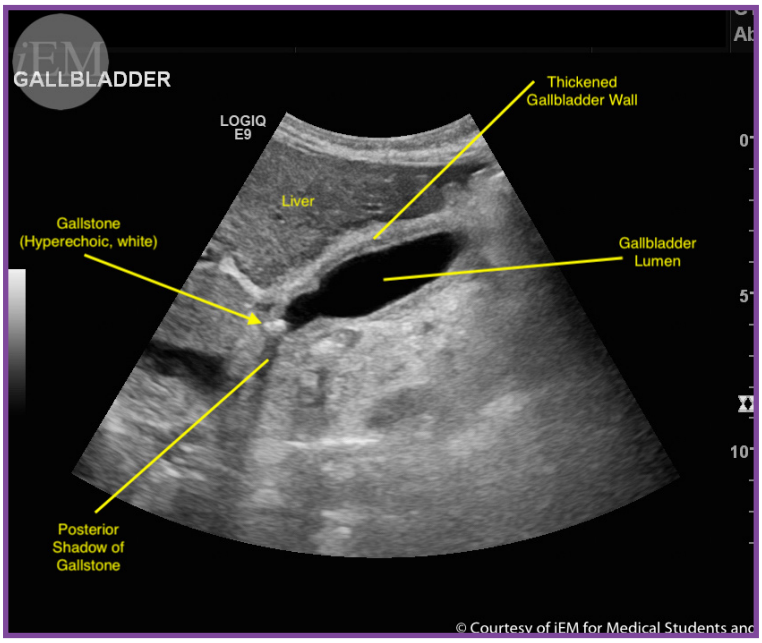
Explanation – Question 38

This patient presents to the Emergency Department with upper abdominal pain, nausea, and vomiting. The physical exam demonstrates fever, tachycardia, and focal right upper quadrant abdominal tenderness. Differential diagnoses to consider include cholecystitis, choledocholithiasis, cholangitis, hepatitis, pancreatitis, and ruptured peptic ulcer. The ultrasound image provided shows a thickened gallbladder wall (>4 mm) and a gallstone present. See the labelled image below.



Signs of acute cholecystitis on ultrasound include a thickened gallbladder wall, pericholecystic fluid (anechoic (black) fluid around gallbladder), the presence of a gallstone (hyperechoic (white) with posterior shadowing), sonographic Murphy sign (tenderness when transducer is pressed into gallbladder), and a dilated gallbladder. This patient has some but not all sonographic signs of cholecystitis. However, the age, obese body habitus, fever, and location of the pain support a diagnosis of acute cholecystitis **(Choice B)**.

Treatment of acute cholecystitis involves IV hydration, parenteral pain management and antiemetics, IV antibiotics, and surgical consultation for cholecystectomy. Biliary colic (Choice A) is less likely, given the ultrasound findings and fever on physical examination. If the patient's vital signs were normal and the ultrasound showed gallstones with no other sonographic signs of cholecystitis, biliary colic would be more likely. Gastritis (Choice C) does not cause fever or the sonographic signs illustrated above. Gallstones are the most common cause of pancreatitis (Choice D), but there is focal tenderness over the gallbladder in the right upper quadrant. Additional findings, such as an elevated lipase level, pain that radiates to the back, or a history of alcohol abuse would make pancreatitis a more likely diagnosis.

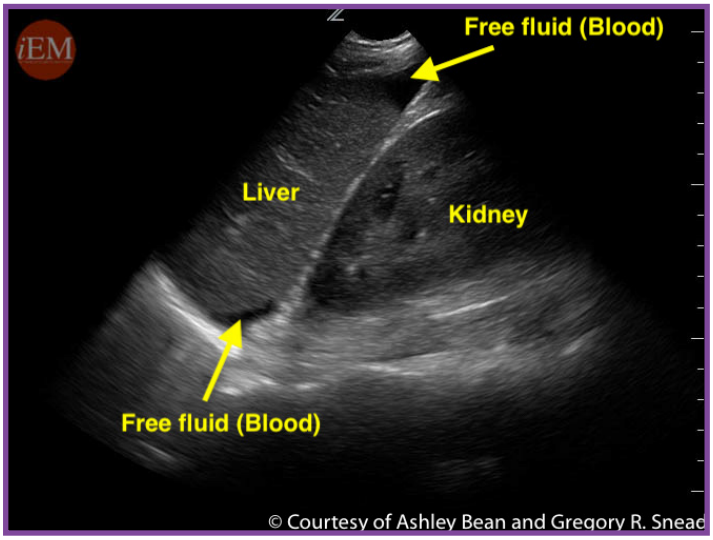
References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
- Nickson, C. (2020). Cholecystitis. Life in the Fast Lane. Retrieved from https://litfl.com/cholecystitis/

Explanation – Question 39

This female patient presents to the Emergency Department with atraumatic right shoulder pain, generalized abdominal discomfort, and vaginal bleeding. She is found to have a positive urine pregnancy test and signs of shock on physical exam (hypotension and tachycardia). The FAST exam (Focused Assessment with Sonography for Trauma) demonstrates free fluid around the liver. This quick bedside sonographic exam evaluates the right upper quadrant (liver, right kidney, right lung base), left upper quadrant (spleen, left kidney, left lung base), suprapubic area (bladder), and subxiphoid area (view

of the heart). The FAST exam is typically used in the setting of trauma to assess for intra-abdominal bleeding, or "free fluid". Fluid on ultrasound appears black, or anechoic. In the setting of trauma or presumed hemorrhagic shock, free fluid is assumed to be blood. The hepato-renal recess, also known as Morrison's pouch, is the most common site for fluid to be seen on a FAST exam. For this reason, the right upper quadrant should always be viewed first during a FAST exam if there is a concern for hemorrhagic shock. The patient's right upper quadrant FAST view is annotated below.



This patient is in shock with free fluid in her right upper quadrant FAST view. In the setting of a pregnancy of unknown origin, shock, and abdominal free fluid, a ruptured ectopic pregnancy is assumed to be the diagnosis. A cystic adnexal structure and a uterus without a gestational sac can also be noted on ultrasound. Ectopic pregnancy can present with mild symptoms ranging from abdominal pain and vaginal bleeding to signs of shock with hemoperitoneum, as in this patient. Risk factors for ectopic pregnancy include prior ectopic pregnancies, prior tubal surgeries, prior sexually transmitted infections, tobacco smoking, and use of an intrauterine device (IUD). Initial Emergency Department treatment should include volume resuscitation with blood products, pre-operative laboratory testing, and prompt OB/GYN consultation **(Choice C)**.

Patients who are unstable, show signs of shock, or have large ectopic pregnancies are treated operatively. Patients with stable vital signs, small ectopic pregnancies, and minimal symptoms are treated medically with Methotrexate (Choice A). This patient's hemodynamic instability makes Methotrexate contraindicated in her treatment course. The patient's atraumatic shoulder pain is likely from free fluid in the right upper quadrant, causing referred pain to the shoulder from diaphragmatic irritation. A shoulder X-ray (Choice B) is not indicated in this patient. Rho(D) immune globulin (RhoGAM) (Choice D) is an important treatment to provide in Rh-negative mothers with ectopic pregnancy. RhoGAM is indicated in maternal-fetal hemorrhage in order to prevent the maternal immune system from attacking fetal Rh-positive cells in future pregnancies. RhoGAM is indicated in Rh-negative mothers, not Rh-positive mothers. The question does not indicate the mother's blood type or Rh status, however, RhoGAM is not the best initial treatment. Treatment of the hemorrhagic shock and OB/GYN consultation are the best next steps.

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
- Nickson, C. (2020). Ectopic Pregnancy. Life in the Fast Lane. Retrieved from https://litfl.com/ectopic-pregnancy/

Explanation – Question 40

This elderly patient presents to the Emergency Department with left lower abdominal pain, constipation, and anorexia. The exam shows fever, tachycardia, and marked left lower quadrant tenderness. Compared to younger patients, abdominal pain in an elderly patient has a higher likelihood of being due to a surgical emergency or from a diagnosis that carries a higher mortality. Elderly patients may have more nonspecific associated symptoms that may make it difficult to confirm a dangerous diagnosis without advanced imaging. Additionally, elderly patients do not always have a fever or elevated white blood cells during an abdominal infection. The differential diagnosis of abdominal pain in an elderly patient should be broad and encompass conditions related to many body systems.

The most likely diagnosis for this patient is diverticulitis based on the location of the pain. Features of diverticulitis include left lower quadrant pain, nausea, vomiting, change in bowel habits (diarrhea or constipation), anorexia, fever, and leukocytosis. Right-sided diverticulitis is more common in patients of Asian descent, so these patients may present with right lower quadrant pain alternatively. Treatment for acute diverticulitis includes antibiotics, bowel rest, hydration, increased dietary fiber, and pain management.

Other potential diagnoses for this patient include perforated diverticulitis, abdominal abscess, colitis, bowel obstruction, malignancy, AAA, urinary tract infection, ureterolithiasis, and soft tissue infections. The best next step in the management of this patient is to treat empirically for an abdominal infection with IV hydration, antipyretics and antibiotics. Sepsis from a gastrointestinal source requires antibiotics that cover gram-negative and anaerobic bacteria. IV Vancomycin (Choice A) is helpful for skin infections, soft tissue infections, MRSA (Methicillin-resistant Staph aureus) infections, or other infections from gram-positive organisms. Vancomycin would not include coverage for a gastrointestinal source. IV Metronidazole covers anaerobic bacteria, and Ciprofloxacin covers gram-negative bacteria. This makes **Choice D** the best antibiotic choice for this patient. Other options include IV ampicillin-sulbactam, ampicillin and metronidazole, piperacillin-tazobactam, ticarcillin-clavulanate, or imipenem. A CT scan on the abdomen and pelvis (Choice B) should be performed on this patient (ideally with PO and IV contrast). However, IV hydration and antibiotics are a more important initial step to address the patient's sepsis. CT scanning is recommended for first-time episodes of diverticulitis or if there are alternative diagnoses on the differential. Patients with a history of recurrent diverticulitis who present to the Emergency Department with uncomplicated acute diverticulitis are able to be treated empirically with oral antibiotics in the outpatient setting. Patients who are ill-appearing, have no prior history of diverticulitis, or have possible alternative diagnoses should get CT imaging. Emergent colonoscopy (Choice C) is not indicated as part of the Emergency Department management of acute diverticulitis. In fact, colonic inflammation or inflamed diverticuli are contraindications to colonoscopy (increased risk of bowel rupture).

References

- Masneri D.A., & O'Brien M (2020). Acute abdominal pain. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 9e. McGraw-Hill. https://accessemergencymedicine.mhmedical.com/content.aspx?bookid=2353&sectionid=189592906
- McSweeney, W. & Sriath, H. (2017). Diverticular disease practice points. Australian Family Physician. 46(11): 829-832. Retrieved from https://www.racgp.org.au/afp/2017/november/diverticular-disease-practice-points/

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Question 41

A 68-year-old man presents to the Emergency Department with confusion and slurred speech. The patient's daughter says she found the patient in a confused state 2 hours ago in his home. She says he was acting normally one day ago, with no fevers, vomiting, diarrhea, or headaches. She notes that the patient has had poor appetite since his wife died last month. The patient's medical history includes end-stage renal disease on hemodialysis, hypertension, and hyperlipidemia. On examination, his temperature is 37°C, blood pressure 150/90 mmHg, pulse 104 beats/min, respiratory rate 20 breaths/min, oxygen saturation is 99% on room air, and glucose level is 45mg/dL (2.5mmol/L). The patient is able to speak and move all extremities, but his speech is slurred and incomprehensible.

Which of the following is the most appropriate next step in management for this patient's condition?

A. CT scan of head without contrast

B. IV hypertonic 3% NaCl

C. IV dextrose

D. IV potassium chloride

Question 42

A 76-year-old man presents to the Emergency Department with altered mental status. The pre-hospital providers state that the patient's wife called for an ambulance as the patient has been increasingly somnolent and confused over the last 1.5 weeks. There is no history of fever, vomiting, headaches, or trauma. The patient's medical history includes Type-2 diabetes, hypertension, and hyperlipidemia. On examination, his temperature is 37°C, blood pressure 140/90 mmHg, pulse 109 beats/min, respiratory rate 18 breaths/min, oxygen saturation is 98% on room air, and glucose level is 700mg/dL (39 mmol/L). The patient is somnolent, moans when his name is called, and responds to painful stimuli appropriately in all extremities. Pupils are 4mm bilaterally and reactive to light.

Which of the following is the most appropriate next step in management for this patient's condition?

A. IV insulin continuous infusion

B. IV hypertonic 3% NaCl

C. IV 0.9% NaCl bolus

D. IV insulin bolus

Question 43

A 70-year-old female presents to the Emergency Department with altered mental status and fever for five days. The patient complains of lower abdominal pain and dysuria but denies headaches, vomiting, diarrhea, coughing, shortness of breath, or new medications. Normally, she is not confused and functions independently. The patient's medical history includes diabetes, hypertension, hyperlipidemia, and a prior appendectomy. On examination, her temperature is 39°C, blood pressure 105/60 mmHg, pulse 128 beats/min, respiratory rate 20 breaths/min, oxygen saturation is 98% on room air, and glucose level is 190mg/dL (10.5mmol/L). The patient is awake and alert but is disoriented. She moves all extremities spontaneously, can follow basic commands and shows no focal neurologic deficits on examination.

Which of the following is the most likely cause for this patient's altered mental status?

A. Diabetic ketoacidosis

B. Sepsis

C. Intracerebral hemorrhage

D. Hypothyroidism

Question 44

A 56-year-old female presents to the Emergency Department with altered mental status and headache for 2 hours. The patient says she had an abrupt onset temporal headache 2 hours ago while sitting at home. The intensity of the headache has improved since its onset, but the patient has become increasingly somnolent and has started vomiting. There is no known history of trauma, syncope, or fevers. The patient has no known medical history. On examination, her temperature is 37°C, blood pressure 175/90 mmHg, pulse 88 beats/min, respiratory rate 18 breaths/min, oxygen saturation is 98% on room air, and glucose level is 100mg/dL (5.5mmol/L). The patient is somnolent and poorly responsive to painful stimuli on arrival. An endotracheal tube is placed with rapid sequence intubation.

Which of the following is the most appropriate next investigation to confirm this patient's diagnosis?

A. Lumbar puncture

B. 12-lead EKG

C. MRI of the brain

D. Noncontrast CT scan of the head

Question 45

A 34-year-old male presents to the Emergency Department with altered mental status. The patient's wife states that he had a 2-minute episode of full-body convulsive movements at home while lying on a sofa. The patient has no history of epilepsy or syncopal episodes. The wife denies the patient sustaining any recent trauma, history of fevers, headaches, or chest pain. The patient has been confused since the convulsive episode ended 30 minutes ago. The patient has no known medical history. On examination, his temperature is 37°C, blood pressure 130/80 mmHg, pulse 95 beats/min, respiratory rate 18 breaths/min, oxygen saturation is 98% on room air, and glucose level is 100mg/dL (5.5mmol/L). The patient is slightly somnolent but is able to follow basic commands. He answers questions appropriately but has a delayed response time. His pants are saturated in urine, and you notice a lateral tongue laceration. While you are examining the patient, his body becomes rigid and begins to have convulsive movements in all extremities.

Which of the following is the most appropriate next step in management for this patient's condition?

A IM haloperidol

B Endotracheal intubation

C Lateral decubitus position and airway suction

D 12-lead EKG

Question 46

A 68-year-old male presents to the Emergency Department with altered mental status, lethargy, and myalgias. The patient's wife states that his symptoms have been ongoing for the last two days. There is no history of fevers, vomiting, diarrhea, sick contacts, or recent travel. The patient's medical history includes hypertension, diabetes, coronary artery disease, and congestive heart failure. On examination, his temperature is 37°C, blood pressure 155/90 mmHg, pulse 110 beats/min, respiratory rate 18 breaths/min, oxygen saturation is 98% on room air, and glucose level is 200mg/dL (11.1mmol/L). The patient is able to speak normally, appears disoriented and confused, cannot follow commands due to confusion, and has no focal motor or sensory deficits. The oral mucosa is dry. Serum chemistry results are as follows:

Test	Test Result	Reference Range
BUN	32	8 - 21 mg/dL
Creatinine	1.5	0.8 - 1.3 mg/dL
Sodium	116	135 - 145 mEq/L
Potassium	4.9	3.5 - 5.0 mEq/L
Chloride	100	95 - 105 mEq/L
CO2	23	22 - 28 mEq/L

Which of the following is the most appropriate next step in management for this patient's condition?

A 1000 mL of IV 0.9% NaCl

B Non-contrast CT scan of the head

C 25 g of IV dextrose

D 150 mL of 3% NaCl

Question 47

A 24-year-old male presents to the Emergency Department with altered mental status after being found on the street. Pre-hospital personnel reported that the patient was lying on the side of the road, nonresponsive. Bystanders called for the patient to be brought to the hospital. The patient's medical history is unknown. On examination, his temperature is 36.5°C, blood pressure 110/70 mmHg, pulse 65 beats/min, respiratory rate five breaths/min, oxygen saturation is 87% on room air, and glucose level is 70 mg/dL (3.9 mmol/L). The patient appears disheveled and lethargic, with minimal response to painful stimuli. Pupils are 2 mm bilaterally. There are no obvious signs of external trauma.

Which of the following is the most appropriate next step in management for this patient's condition?

A 1000 mL bolus of 0.9% NaCl

B 25 g of IV dextrose

C 1 mg of IV naloxone

D 100 mg of IV thiamine

Question 48

An obese 56-year-old female presents to the Emergency Department with altered mental status. The patient's family reported that she was noted to be somnolent in bed 3 hours ago. There is no known history of fever, drug abuse, ingestions, or recent travel. The patient's medical history includes chronic obstructive pulmonary disease, morbid obesity, hypertension, and diabetes. On examination, her temperature is 37°C, blood pressure 165/90 mmHg, pulse 85 beats/min, respiratory rate 10 breaths/min, oxygen saturation is 85% on room air, and glucose level is 110mg/dL (6.1mmol/L). The patient appears somnolent with minimal response to painful stimuli. Pupils are 4mm bilaterally. There are no obvious signs of external trauma. Supplemental oxygen is provided via nonrebreather face mask with improved SpO2 to 94%; however, the patient remains somnolent. The patient's arterial blood gas results are below.

Test	Test Result	Reference Range
pH	7.26	7.35 - 7.45
pO2	85	80 - 100 mmHg
pCO2	92	35 - 45 mmHg
HCO3	26	22 - 26 mEq/L

Which of the following is the most likely cause of this patient's condition?

A Hypercarbic respiratory failure
B Hypoxic respiratory failure
C Opioid overdose
D Sepsis

Question 49

A 42-year-old male presents to the Emergency Department with altered mental status while exercising in a park. The patient was found by bystanders running around the neighborhood park, tachypneic and appearing disoriented. The patient's medical history is unknown. On examination, his temperature is 41°C, blood pressure 92/50 mmHg, pulse 135 beats/min, respiratory rate 22 breaths/min, oxygen saturation is 97% on room air, and glucose level is 70 mg/dL (3.9 mmol/L). The patient appears somnolent and disoriented but is able to speak. The skin is warm and dry. Pupils are 4 mm bilaterally.

Which of the following is the most likely cause of this patient's condition?

A Sympathomimetic toxicity
B Heat exhaustion
C Heat stroke
D Thyroid storm

Question 50

A 46-year-old female presents to the Emergency Department with altered mental status and combativeness. The patient's family states the patient has been increasingly confused and agitated over the last five days. They state she has medical problems but has not been taking her medications for the last three weeks. There is no known history of psychiatric conditions or drug abuse. On examination, her temperature is 39°C, blood pressure 175/95 mmHg, pulse 145 beats/min, respiratory rate 20 breaths/min, oxygen saturation is 98% on room air, and glucose level is 110 mg/dL (6.1 mmol/L). The patient appears restless, psychotic, and confused. The skin is hot and diaphoretic. Pupils are 4 mm bilaterally. A 12-lead EKG shows atrial fibrillation with a rapid ventricular rate.

Which of the following is the most appropriate next step in management for this patient's condition?

A IV Physostigmine
B IV Potassium iodide
C IV Propranolol
D PO Propylthiouracil (PTU)

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Explanation – Question 41

This patient presents to the Emergency Department with altered mental status. This presenting symptom can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic outlines this mnemonic.

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ALTERED MENTAL STATUS
AEIOU TIPS
A
ALCOHOL
Although altered mental status may need higher blood alcohol concentration (BAC), BAC above 0.5 pro mille, 50 mg/dl, or 0.05% is considered potentially dangerous to drive in many countries.
E
ELECTROLYTE, ENDOCRINE, EPILEPSY, ECP
Hypernatremia is the most common electrolyte abnormality causing AMS. Hypo or hyperthyroidism, Addison crisis, hypo-hyper glycemia (DKA and HHS). Metabolic or toxic encephalopathy. Epilepsy.
I
INFECTION
Particularly sepsis, severe sepsis, and septic shock situations should be considered. However, CNS infections (meningitis, encephalitis) are also common.
O
OVERDOSE, OPIOID, OXYGEN
Drug overdoses such as benzodiazepine, TCA, SSRI, OPIOID are common causes. Hypoxemia cause agitation. Besides, hypercapnia causes drowsiness.
U
UREMIA
There are three significant components of serum osmolarity which affect mental status. Urea is one of them. Calculated osmolality = 2[Na+] + [Glucose]/18 + [BUN]/2.8 + [Ethanol]/3.7. Any increase of a component results in high osmolarity which causes disequilibrium, and as a potential result, AMS.
T
TRAUMA, TEMPERATURE, TOXICITY
For toxicity, look "O." Trauma to the head may cause a concussion, bleeding, or DAI. But, the hypovolemic shock and obstructive shock (e.g., tension pneumothorax) should also be considered. Hyperthermia and hypothermia affect mental status, especially in extreme ages.
I
INSULIN
Insulin is one of the drugs that can affect mental status in patients with diabetes type I and cases presented with a suicidal attempt. Too much or too little causing hypoglycemia or hyperglycemia
P
PSYCHOGENIC OR POISONINGS
We should eliminate any pathology caused by various diseases and drugs first. However, we need to keep in mind that acute or chronic psychological problems may cause AMS.
S
SHOCK, SEPSIS, SOL, SAH, STROKE
Shock situations, sepsis, space-occupying lesions, subarachnoid hemorrhage, stroke should be considered in patients where clinical findings are relevant.
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This patient is awake and moving all extremities, but with obvious confusion and dysarthria. Ordering a CT scan of the head without contrast (Choice A) may be helpful in this patient to evaluate for intracerebral hemorrhage, stroke, or a brain mass. However, the question stem indicates that this patient has a low glucose level. Glucose is considered low at levels below 70mg/dL (3.9 mmol/L); however, the absence of any symptoms can be reassuring. Glucose levels that are more severely low (less than 40mg/dL (2.2 mmol/L)) are more concerning than levels that are only moderately low (less than 70mg/dL (3.9mmol/L)). All patients with altered mental status should have a point-of-care glucose test. Both hypoglycemia and severe hyperglycemia can cause altered mental status. Hypoglycemia, if left untreated, can cause permanent brain damage. For this reason, the prompt identification of low blood glucose is critical so it can be treated rapidly. Administration of IV hypertonic 3% NaCl (Choice B) would be helpful in a patient with severe hyponatremia with altered mental status or seizure. However, the question stem provides a cause for the patient's symptoms (low glucose). IV potassium chloride (Choice D) would be helpful in the case of hypokalemia. Severe hypokalemia can cause weakness and arrythmias, but does not cause dysarthria.. This patient is at higher risk for hyperkalemia as he is a hemodialysis patient, but no evidence is given that he has hyperkalemia (i.e., peaked T waves on EKG or widened QRS interval). Again, a low glucose level is provided in the question stem, which should be treated first.

IV dextrose **(Choice C)** is the best next step in the management of this patient's hypoglycemia. This patient has had poor oral intake and has end-stage renal disease. Insulin is excreted by the kidneys, so patients with end-stage renal disease are more prone to insulin "buildup" and hypoglycemia. In addition to administering IV dextrose (i.e. D50 bolus), providing food with complex carbohydrates is important to prevent recurring hypoglycemic episodes. If the patient continues to have persistent hypoglycemia despite an IV dextrose bolus and food, a continuous IV dextrose infusion (i.e. D10W at 100cc/hour) and admission for further evaluation should be considered.

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- Farkas, J. (2017). Hypoglycemia. EMCRIT: The Internet Book of Critical Care. Retrieved from

Explanation – Question 42

This patient presents to the Emergency Department with altered mental status. This presenting symptom can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.

This patient has a markedly elevated glucose level. All patients with altered mental status should have a point-of-care glucose test, as both hypoglycemia and severe hyperglycemia can cause altered mental status. Some diagnoses to consider in this patient are diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS). Both of these diagnoses can present with hyperglycemia and altered mental status, but HHS more often presents with higher glucose levels (greater than 600mg/dL (33mmol/L)) and more pronounced Central Nervous System depression. Patients with HHS may have severe somnolence to the point of coma and may require intubation for airway protection. In both DKA and HHS, patients are severely dehydrated by osmotic diuresis. High glucose levels in the serum create an osmotic gradient that causes increased urination and fluid loss. The first step in treatment for DKA and HHS is volume resuscitation.

IV fluids **(Choice C)** should be given prior to the initiation of insulin therapy (Choices A and D). After adequate IV hydration and correction of electrolyte derangements, insulin can be started to normalize glucose levels. Bolus doses of IV insulin (Choice D) are harmful in both DKA and HHS and increase the risk of cerebral edema development. For this reason, an IV insulin continuous infusion (Choice A) is always preferred over an insulin bolus (Choice D). IV hypertonic 3% NaCl (Choice B) is the treatment for severe hyponatremia causing altered mental status or seizure. Severe hyperglycemia can cause pseudohyponatremia, but this can be corrected by using the standard sodium correction formula (see references below). The question stem provides an explanation for this patient's altered mental status (hyperglycemia), so hypertonic saline should not be given with the information provided. IV fluid administration (Choice C) is the next best step.

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Explanation – Question 43

This patient presents to the Emergency Department with altered mental status and fever. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.

This patient has confusion, fever, lower abdominal pain, dysuria, and no focal neurological deficits on physical examination. Diabetic ketoacidosis (Choice A) is unlikely as the patient does not have marked hyperglycemia (>250 mg/dL (13.8 mmol/L)), polyuria, or polydipsia. Intracranial hemorrhage (Choice C) is unlikely as the patient has no headache, history of trauma, focal neurologic deficits, or coma. Severe hypothyroidism (Choice D), known as myxedema coma, can cause altered mental status. This condition is marked by somnolence or coma, hypothermia, nonpitting edema on the hands and feet, dry skin, macroglossia (enlarged tongue), and hair loss. This patient does not have symptoms consistent with severe hypothyroidism.

Sepsis **(Choice B)**, especially in elderly individuals, can cause altered mental status. The patient's fever, confusion, lower abdominal pain, and dysuria all point to a likely diagnosis of urosepsis. Sepsis is the most likely cause of this patient's disoriented state. Treatment with early IV hydration and antibiotics will help remedy the patient's altered mental status.

References

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Explanation – Question 44

This patient presents to the Emergency Department with altered mental status after a convulsive episode. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.

The information provided indicates that the patient's headache was maximal at onset, severe, associated with vomiting, and led to a deteriorating mental status, ultimately requiring intubation. This history is very concerning for intracranial bleeding, especially subarachnoid hemorrhage (SAH). The majority of atraumatic SAHs are caused by the rupture of a saccular aneurysm. This causes the leakage of blood into the subarachnoid space. Symptoms of a SAH are sudden onset headache that is the maximal intensity at onset ("thunderclap headache"), syncope, vomiting, seizures, and any neurological deficits. Risk factors for SAH are age over 50years-old, family history of SAH, alcohol abuse, tobacco smoking, Marfan Syndrome, Ehlers-Danlos Syndrome, and Polycystic Kidney Disease. Diagnosis of SAH takes into account the patient's history, physical exam, and risk factors.

Patients that arrive in the Emergency Department under 6 hours after symptom onset should initially get a non-contrast CT scan of the head **(Choice D)**. When a non-contrast head CT is performed in this time window, its sensitivity reaches 98-100%. Non-contrast head CT performed within the first 24 hrs since headache onset has a sensitivity of about 90%. Patients with signs and symptoms concerning SAH with a negative CT head should get a lumbar puncture (Choice A) to evaluate for xanthochromia. This is especially important if the patient's symptoms have been for over 6 hours. If available, a CTA (CT angiogram) of the head is a reasonable alternative to a lumbar puncture when the noncontrast CT head does not show a bleed, and the duration of symptoms has been greater than 6 hours. A 12-lead EKG (Choice B) can show ST and T wave changes, but an EKG alone cannot be used to make a diagnosis of SAH. A brain MRI (Choice C) can make the diagnosis of SAH, but a CT scan would be preferred due to greater CT scan accessibility, cost, and the shorter time of this imaging test. The best next investigation would be a non-contrast CT of the head (Choice D).

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Explanation – Question 45

This patient presents to the Emergency Department with altered mental status after a convulsive episode. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.This patient's altered mental status is likely due to a post-ictal state after a first-time seizure. A seizure occurs when the brain is in a state of neuronal hyperactivity. First-time seizures can be caused by various factors, such as hypoxia, hyperthermia, hypoglycemia, traumatic brain injury, brain tumors, meningitis, encephalitis, hyponatremia, or alcohol withdrawal. It can sometimes be challenging to differentiate a seizure from a syncopal episode. Both conditions cause loss of consciousness, and both may include body convulsions. Details supporting a seizure over syncope diagnosis include bowel or bowel incontinence, tongue biting, and confusion after regaining consciousness (post-ictal state).

Management of a patient having a seizure should focus initially on the ABCs (Airway-Breathing-Circulation) and terminating the seizure. This involves first repositioning the patient to prevent aspiration. A common maneuver is rolling the patient in the lateral decubitus position, performing a jaw thrust, and suctioning the airway **(Choice C)**. Administration of IM haloperidol (Choice A) is unlikely to terminate the seizure as it is an antipsychotic, not an antiepileptic medication. Obtaining a 12-lead EKG (Choice D) is an important aspect of evaluating a patient with a potential seizure; however, the next best step in this seizing patient should focus on the ABCs and terminating the seizure. Endotracheal intubation (Choice B) may be necessary for this patient to protect the airway, but patient repositioning (Choice C) and antiepileptic (i.e., benzodiazepines) administration are important initial steps before considering intubation. The best next step in this scenario is Choice C.

References

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Explanation – Question 46

This patient presents to the Emergency Department with altered mental status, lethargy, and myalgias. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.

The serum chemistry results show elevated BUN and Creatinine with a BUN/Cr ratio of 21.3. A BUN/Cr ratio greater than 20 indicates decreased perfusion to the kidneys, also known as pre-renal azotemia, which can indicate dehydration, hypovolemia, or shock. The serum chemistry also shows a severely low sodium level. Hyponatremia can present with various symptoms, including weakness, fatigue, myalgias, nausea, vomiting, headaches, altered mental status, focal neurologic deficits, seizures, or coma. Hyponatremia can be acute or chronic, asymptomatic or symptomatic, and mild or severe. Sodium levels below 120 mEq/L are severely low. Neurologic symptoms, such as seizures, altered mental status, and focal neurologic deficits, are also considered severe. Treatment should be based on patient symptoms rather than the sodium level, as it can be difficult to assess the acute or chronic hyponatremia state on initial evaluation. As seen in this scenario, any severe neurologic symptoms should prompt administration of hypertonic saline (3% NaCl). This allows for rapid correction of serum sodium levels, which should relieve the neurologic symptoms. A 100-150 mL IV bolus of 3% NaCl can be given a second time if symptoms continue after 5-10 minutes.

Typically, hyponatremia should be corrected slowly to avoid central pontine myelinolysis. Increases in sodium greater than 8 mEq/L per 24 hours should be avoided for this reason. However, rapid correction of sodium is opted for in the case of neurologic symptoms to prevent further damage.

Administration of "normal saline", or 1000mL of IV 0.9% NaCl (Choice A), can increase the sodium level. However, normal saline is not concentrated enough to rapidly increase the serum sodium to terminate neurologic symptoms. A non-contrast CT scan of the head (Choice B) is a reasonable investigation for this altered patient, but hypertonic saline should be administered first if hyponatremia is known. Administration of 25mg IV dextrose (Choice C), also known as "D50", would be helpful in a patient with hypoglycemia and altered mental status. However, this patient is not hypoglycemic. Administration of hypertonic saline (Choice D) is the best next step for this patient with severe hyponatremia and neurologic symptoms.

References

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Explanation – Question 47

This patient presents to the Emergency Department with altered mental status, hypoxia, and respiratory depression. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of question 41 outlines this mnemonic.

The initial approach to all Emergency Department patients, especially those with abnormal vital signs, should include a primary survey ("ABCs", or Airway, Breathing, Circulation). This patient is breathing independently but at a significantly reduced rate and is hypoxic. Hypoxia should prompt the administration of supplemental oxygen to the patient and reassessment of the SpO2. The patient's reduced respiratory rate, lethargy, and bilateral miosis (constricted pupils) should strongly hint at the possibility of opioid overdose. Although the patient is lethargic and hypoxic, establishing a definitive airway (endotracheal intubation) should be avoided until after the antidote to opioid overdose is administered. Naloxone is a mu-opioid receptor antagonist and functions as the antidote to opioid overdose.

Administration of 1000mL of 0.9% NaCl (Choice A) is unlikely to fix the patient's clinical condition. The patient needs naloxone to improve respiratory status. 25g of IV dextrose (Choice B) would be helpful if this patient's altered mental status was from hypoglycemia. A normal glucose level is provided in the question stem. 100mg of IV thiamine (Choice D) may be helpful in the case of Wernicke-Korsakoff Syndrome, a state of thiamine deficiency often associated with malnutrition and alcohol abuse. Wernicke-Korsakoff Syndrome presents with vision disturbances, ataxia, and confusion. Typically, this syndrome does not present with severe lethargy or depressed mental status as is seen in this patient.

The best next step in management is 1mg of IV naloxone (Choice C). If given appropriately, naloxone can prevent the need for intubation. Naloxone has a very short onset to action (~1min). If suspicion for opioid overdose is high and there is an inadequate respiratory response after a single naloxone

dose, repeat doses of naloxone are appropriate. Naloxone can be administered in repeat boluses every 3-minutes to a total dose of 10mg IV. Patients who respond appropriately to naloxone should be observed for recurrent respiratory depression as naloxone is cleared. Need for repeat doses of naloxone indicates the need for a continuous naloxone infusion and hospital admission. The typical infusion dose is 2/3 the "wake-up" dose given over 1 hour as a continuous infusion. For example, if the patient responded to 1mg IV initially, the continuous infusion dose would be 0.6mg/hour of IV naloxone.

References

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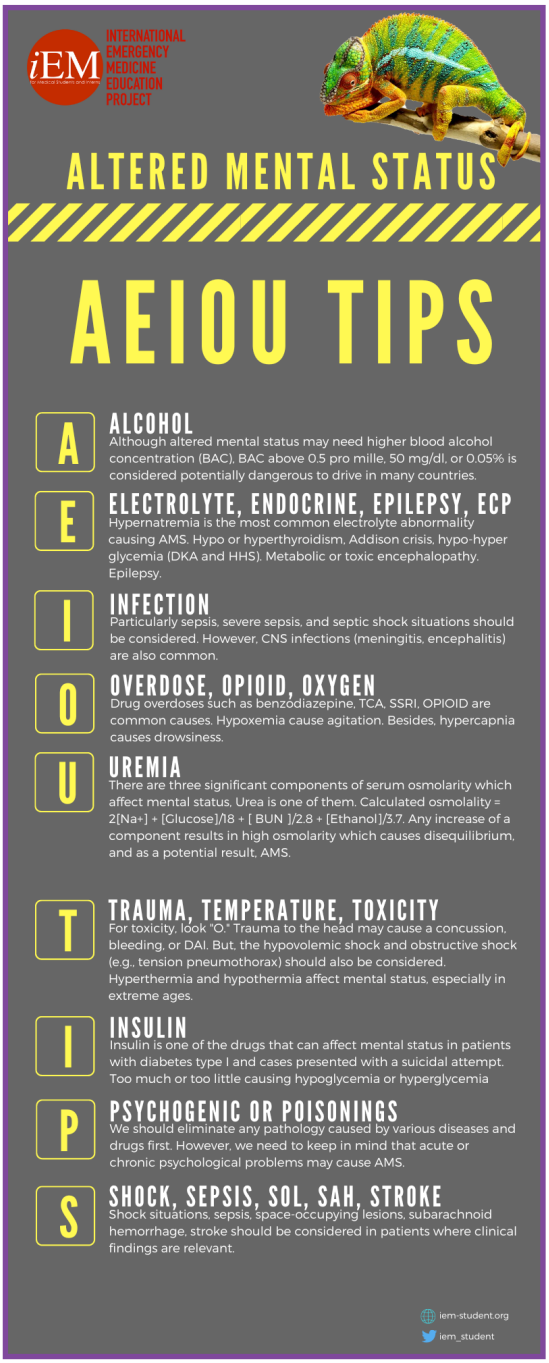
Explanation – Question 48


iEM
INTERNATIONAL EMERGENCY MEDICINE EDUCATION PROJECT
ALTERED MENTAL STATUS
AEIOU TIPS
A
ALCOHOL
Although altered mental status may need higher blood alcohol concentration (BAC), BAC above 0.5 pro mille, 50 mg/dl, or 0.05% is considered potentially dangerous to drive in many countries.
E
ELECTROLYTE, ENDOCRINE, EPILEPSY, ECP
Hypernatremia is the most common electrolyte abnormality causing AMS. Hypo or hyperthyroidism, Addison crisis, hypo-hyper glycemia (DKA and HHS). Metabolic or toxic encephalopathy. Epilepsy.
I
INFECTION
Particularly sepsis, severe sepsis, and septic shock situations should be considered. However, CNS infections (meningitis, encephalitis) are also common.
O
OVERDOSE, OPIOID, OXYGEN
Drug overdoses such as benzodiazepine, TCA, SSRI, OPIOID are common causes. Hypoxemia cause agitation. Besides, hypercapnia causes drowsiness.
U
UREMIA
There are three significant components of serum osmolarity which affect mental status, Urea is one of them. Calculated osmolality = 2[Na+] + [Glucose]/18 + [BUN]/2.8 + [Ethanol]/3.7. Any increase of a component results in high osmolarity which causes disequilibrium, and as a potential result, AMS.
T
TRAUMA, TEMPERATURE, TOXICITY
For toxicity, look "O." Trauma to the head may cause a concussion, bleeding, or DAI. But, the hypovolemic shock and obstructive shock (e.g., tension pneumothorax) should also be considered. Hyperthermia and hypothermia affect mental status, especially in extreme ages.
I
INSULIN
Insulin is one of the drugs that can affect mental status in patients with diabetes type I and cases presented with a suicidal attempt. Too much or too little causing hypoglycemia or hyperglycemia
P
PSYCHOGENIC OR POISONINGS
We should eliminate any pathology caused by various diseases and drugs first. However, we need to keep in mind that acute or chronic psychological problems may cause AMS.
S
SHOCK, SEPSIS, SOL, SAH, STROKE
Shock situations, sepsis, space-occupying lesions, subarachnoid hemorrhage, stroke should be considered in patients where clinical findings are relevant.
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This patient presents to the Emergency Department with altered mental status and hypoxia. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic outlines this mnemonic.

The first step in managing this patient should be to treat the hypoxia with supplemental oxygen. Prolonged hypoxia is dangerous and, if left untreated, can cause brain damage. In addition, hypoxia can cause altered mental status; however, when this patient's hypoxia is resolved, she remains somnolent and altered. This should raise concern over an alternative etiology for the patient's condition.

The arterial blood gas demonstrates a low pH (acidosis), normal paO2, elevated paCO2 (hypercarbia), and a normal HCO3 (no metabolic compensation for acidosis). Therefore, the final interpretation of the ABG would be acute respiratory acidosis without metabolic compensation. As seen in this patient, acute elevations of pCO2 can manifest as somnolence and altered mental status. This is known as hypercarbic or hypercapnic respiratory failure **(Choice A)**. This condition is caused by the inability to exhale CO2. Risk factors include obstructive lung diseases (i.e., COPD), obesity, and obstructive sleep apnea. Treatment involves supplemental oxygen, non-invasive positive pressure ventilation (i.e., BI-

PAP, CPAP, High Flow Nasal Cannula), and treatment of the underlying cause.The patient's arterial blood gas does not show hypoxic respiratory failure (Choice B). Since treatment of the patient's hypoxia does not improve the patient's mental status, hypercarbic respiratory failure is more likely the underlying cause of the patient's condition. Opioid overdose (Choice C) can cause a similar ABG and patient presentation. However, the normal-size pupils and absent history of drug abuse make this diagnosis less likely. Sepsis (Choice D) can trigger changes in mental status and cause respiratory failure; however, the absence of infectious symptoms and the presence of obesity and COPD support hypercarbic respiratory failure as the more likely underlying cause.

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Explanation – Question 49

This patient presents to the Emergency Department with altered mental status while exercising outdoors. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic provided in the explanation of questions 41 and 48 outlines this mnemonic.

Hyperthermia (or hypothermia) can cause altered mental status. This patient arrives with altered mental status, severe hyperthermia, tachycardia, tachypnea, and hypotension. The patient's history of running outside for exercise should raise concern for hyperthermia related to excess heat production due to overexertion. This should narrow the differential diagnoses to heat exhaustion (Choice B) and heat stroke **(Choice C)**. Both heat exhaustion and heat stroke are marked by hyperthermia, with temperatures often over 40°C. Additional symptoms include weakness, nausea, vomiting, myalgias, syncope, and headache. The differentiating factor between heat exhaustion and heat stroke is altered mental status and sweating. Patients with heat exhaustion lack altered mental status and should still be able to thermoregulate through sweating.

On the contrary, heat stroke patients are more severely ill as they have altered mental status and can no longer thermoregulate with sweating. The treatment in both conditions should be early and aggressive cooling measures. This includes full body immersion in an ice bath, removal of clothes, and cold IV fluids. Internal cooling with gastric, bladder, pleural, or peritoneal lavage with cold fluids can be done on more sick patients. Antipyretic medications, like NSAIDs and paracetamol, have no benefit in patients with severe hyperthermia. Evaluation for rhabdomyolysis, kidney failure, liver failure, sepsis, or other organ dysfunction should also be a part of the evaluation of hyperthermic patients.

Sympathomimetic toxicity (Choice A) is possible but less likely as the skin is dry and the history of exercise outdoors. Sympathomimetic toxicity manifests as diaphoresis, tachycardia, hypertension,

hyperthermia, and sometimes altered mental status. Thyroid storm (Choice D) is another possibility. This diagnosis can also present with similar vital signs, hyperthermia, and altered mental status. Again, the history of outdoor exercise should point more towards heat exhaustion vs heat stroke. The diagnosis of this patient is heat stroke (Choice C), as he has altered mental status and lacks wet skin.

References

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Explanation – Question 50

This patient presents to the Emergency Department with altered mental status and psychosis. Altered mental status can be due to a large variety of etiologies, including hypoglycemia, sepsis, toxic ingestions, electrolyte abnormalities, stroke, and more. The management and evaluation of a patient with altered mental status depend on the primary assessment of the patient ("ABCs", or Airway, Breathing, Circulation) to identify any acute life-threatening conditions that need to be managed emergently, the history and the physical examination. One mnemonic that may help in remembering the many causes of altered mental status is "AEIOUTIPS". The infographic in the explanation of questions 41 and 48 outlines this mnemonic.

This patient arrives hyperthermic, tachycardic in atrial fibrillation, diaphoretic, and altered with psychotic behavior. Thyroid storm, the most severe manifestation of hyperthyroidism, should always be on the differential diagnosis in patients with fever and altered mental status. Other considerations are sepsis, sympathomimetic overdose, anticholinergic overdose, serotonin syndrome, and pheochromocytoma. This patient has thyroid storm, a life-threatening endocrine emergency that requires prompt recognition and treatment. Symptoms of thyroid storm include altered mental status, psychosis, seizures, coma, tachycardia, atrial fibrillation, high-output heart failure, dyspnea, vomiting, diarrhea, weight loss, and anterior neck enlargement. Severe hyperthyroidism should have a low-undetectable TSH level with elevated T3/T4 levels, but these levels may be unreliable in acute illness. For this reason, the diagnosis and treatment of thyroid storm should be based on clinical grounds.

An anticholinergic toxidrome can appear similar to this patient with tachycardia, hypertension, agitation, and altered mental status. A key differentiating factor is diaphoresis. Patients with anticholinergic ingestions should have dry skin, not wet skin. The treatment for anticholinergic toxicity is benzodiazepines and IV physostigmine (Choice A) if symptoms are unresponsive to benzodiazepines. Physostigmine is not the best next step in this scenario. Treatment of thyroid storm is algorithmic. First, beta-blockade **(Choice C)** should be given to control the heart rate and block T4 to T3 conversion, next anti-thyroid medications (Methimazole or Propylthiouracil (Choice D)) should be given to block thyroid hormone synthesis. Lastly, corticosteroids and inorganic iodine (Choice B) can be given to block the release of stored thyroid hormone. The best next step in managing this patient with thyroid storm is administration of IV Propranolol (Choice C). Propranolol helps manage the tachycardia and systemic symptoms and inhibits the conversion of T4 to T3.

References

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Question 51

A 32-year-old woman presents to the Emergency Department complaining of fever, left flank pain, and dysuria for seven days. The pain has worsened over the last two days and is now associated with nausea but no vomiting or diarrhea. The patient has no known past medical or surgical history. On examination, her temperature is 39°C, blood pressure 88/50 mmHg, pulse 135 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. Lungs are clear to auscultation, and the abdomen is soft and nontender. The left costovertebral angle is tender to percussion with no overlying rash. Urinalysis shows numerous WBCs and positive nitrites. Urine HCG testing is negative.

Which of the following is the most likely cause of this patient's condition?

A. Hypovolemic shock

B. Distributive shock

C. Obstructive shock

D. Cardiogenic shock

Question 52

A 23-year-old man presents to the Emergency Department complaining of dyspnea and body pruritis over the last 30 minutes. The patient states that the symptoms began while eating at a restaurant with his family and have been worsening since the onset. The patient has no past medical or surgical history and no known allergies. He is not taking any daily medications or supplements. On examination, his temperature is 37°C, blood pressure 88/50 mmHg, pulse 120 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 94% on room air. The patient has mild angioedema of the upper lip and tongue but speaks with a clear voice. Auscultation of the lungs reveals bilateral expiratory wheezes with no stridor.

Which of the following is the most appropriate next step in management for this patient's condition?

A. IV normal saline

B. IV diphenhydramine

C. IM epinephrine

D. Endotracheal intubation

Question 53

A 40-year-old man presents to the Emergency Department after a high-speed motor vehicle accident where the patient was a driver restrained by a seatbelt. The patient reports that another car stopped abruptly, causing him to swerve and hit a cement divider head-on. The patient complains of posterior neck pain and a tingling sensation in the right upper extremity. The patient has no medical history and takes no daily medications. On examination, his temperature is 37°C, blood pressure 80/40 mmHg, pulse 45 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. Cervical spine immobilization is established, large bore IV lines are placed, and IV fluids are initiated. The lungs are clear to auscultation bilaterally, and the extremities are warm distally. A CT scan of the cervical spine demonstrates a vertebral body fracture at the C6 level.

Which of the following is the most likely cause of this patient's condition?

A. Increased systemic vascular resistance (SVR)

B. Occult hemorrhage

C. Damage to the sympathetic nervous system

D. Tension pneumothorax

Question 54

A 32-year-old farmer presents to the Emergency Department complaining of shortness of breath and chest pain after he was kicked by a horse in the chest. The patient denies sustaining injuries in other locations. He has no past medical or surgical history. He takes no medications daily. On examination, his temperature is 37°C, blood pressure 85/40 mmHg, pulse 125 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. Lungs are clear to auscultation, and the abdomen is soft and nontender. There is a large ecchymosis over the chest with crepitus palpated over the sternum. A bedside ultrasound is performed to assess for internal injuries. One ultrasonographic view is below.

Which of the following is the most likely cause of the patient's condition?

A. Hypovolemic shock

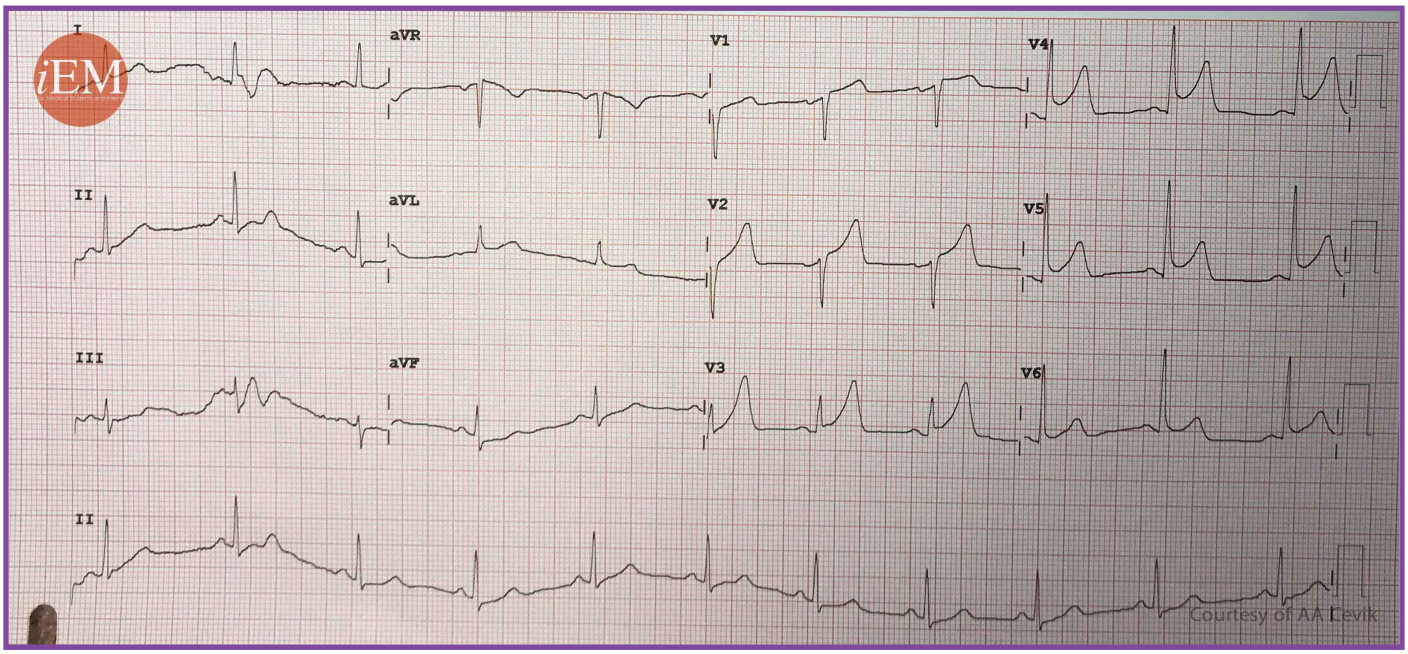
B. Distributive shock

C. Obstructive shock

D. Cardiogenic shock

Question 55

A 72-year-old woman presents to the Emergency Department complaining of chest pressure that began 1 hour ago while watching television. The pain radiates down the left arm and is associated with nausea and vomiting. The patient's medical history includes diabetes, hypertension, hyperlipidemia, and obesity. On physical examination, her temperature is 37°C, blood pressure 85/60 mmHg, pulse 70 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 96% on room air. The patient has clear bilateral lungs and cool distal extremities. A 12-lead EKG is performed on arrival and demonstrated below.



Which of the following is the most likely cause of this patient's condition?

A Hypovolemia

B Systemic infection

C Pulmonary embolism

D Poor cardiac output

Question 56

A 38-year-old woman presents to the Emergency Department with shortness of breath and right-sided chest pain after an assault. The patient states she was punched and kicked multiple times in the chest and back about 40 minutes prior to arrival. The shortness of breath has become more severe over the last 10 minutes before arriving to the hospital. On examination, her temperature is 37°C, blood pressure 80/50 mmHg, pulse 125 beats/min, respiratory rate 26 breaths/min, and oxygen saturation is 88% on room air. The patient's airway is patent, lung sounds are absent on auscultation of the right chest, and distended neck veins are noted.

Which of the following is the most likely cause of this patient's condition?

A Hypovolemic shock

B Distributive shock

C Obstructive shock

D Cardiogenic shock

Question 57

A 28-year-old woman presents to the Emergency Department complaining of dizziness, fatigue, nausea, and generalized abdominal pain for one day. The patient denies fevers, vomiting, diarrhea, syncope, or headaches. The patient has no known medical or surgical history. The patient cannot recall her last menstrual period. On examination, her temperature is 37°C, blood pressure 80/50 mmHg, pulse 135 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 97% on room air. The patient appears diaphoretic and uncomfortable. Lungs are clear to auscultation, and the abdomen is soft, mildly distended, and diffusely tender. Urine HCG testing is positive. A bedside abdominal ultrasound is performed. A right upper quadrant view is shown below.

Which of the following is the most likely cause for this patient's condition?

- **A** Hypovolemic shock
- **B** Distributive shock
- **C** Obstructive shock
- **D** Cardiogenic shock

Question 58

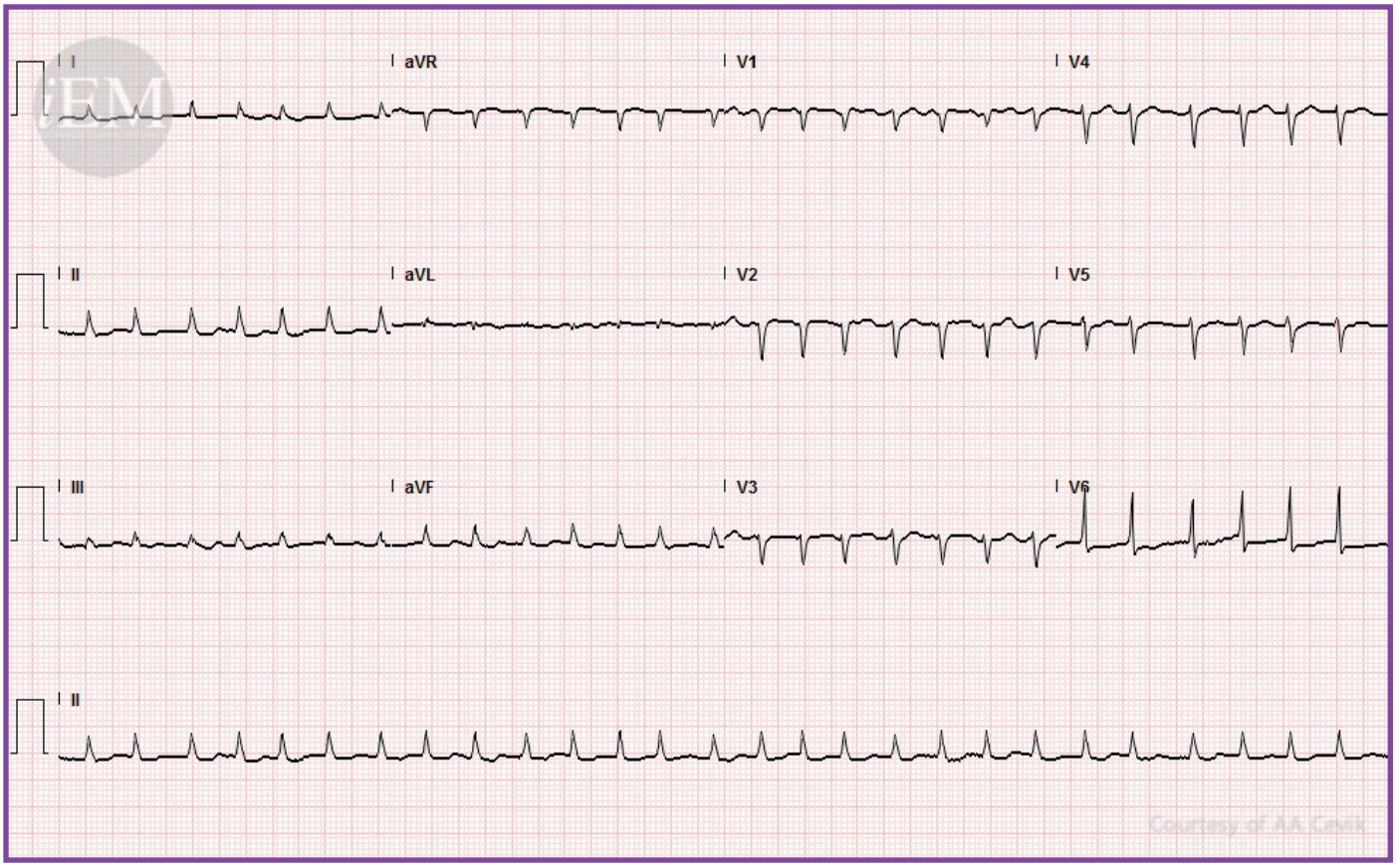
A 56-year-old man presents to the Emergency Department complaining of epigastric pain and 1 episode of hematemesis at home prior to arrival. The patient's medical history includes alcoholic cirrhosis, hypertension, and diabetes. On examination, his temperature is 37°C, blood pressure 110/75 mmHg, pulse 98 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. A complete blood count shows a hemoglobin of 8.8 g/dL (Reference range 12.0 – 15.0 g/dL). The patient is later found diaphoretic and disoriented after having an episode of hematemesis in the bathroom (See image). Repeat vital signs are blood pressure 70/40 mmHg and pulse 128 beats/min.

Which of the following is the most appropriate next step in management?

- **A** 1000 mL IV Normal Saline
- **B** 1 Unit Packed Red Blood Cells
- **C** IV Ceftriaxone
- **D** IV Pantoprazole

Question 59

A 63-year-old woman presents to the Emergency Department complaining of palpitations, generalized weakness, and shortness of breath for three days. The patient states that she stopped taking all her medications three days ago as she ran out of the prescriptions. The patient's medical history includes hypertension and atrial fibrillation. On examination, her temperature is 37°C, blood pressure 86/40 mmHg, pulse 162 beats/min, respiratory rate 30 breaths/min, and oxygen saturation is 87% on room air. The patient appears in respiratory distress with bilateral pulmonary crackles auscultated. A 12-lead EKG is performed and is below.



Which of the following is the most likely cause of this patient's respiratory condition?

A Pulmonary embolism

B Cardiac arrhythmia

C Dehydration

D Systemic infection

Question 60

A 27-year-old woman presents to the Emergency Department complaining of generalized weakness, nausea, and non-bloody vomiting for seven days. The patient is currently 10 weeks pregnant. She denies any fevers, abdominal pain, diarrhea, vaginal bleeding or discharge. The patient has no known past medical or surgical history. On examination, her temperature is 37°C, blood pressure 85/50 mmHg, pulse 122 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. Lungs are clear to auscultation, and the abdomen is soft and nontender. There is no blood noted on pelvic exam. Urinalysis shows 2 WBCs, 0 RBCs, and many ketones.

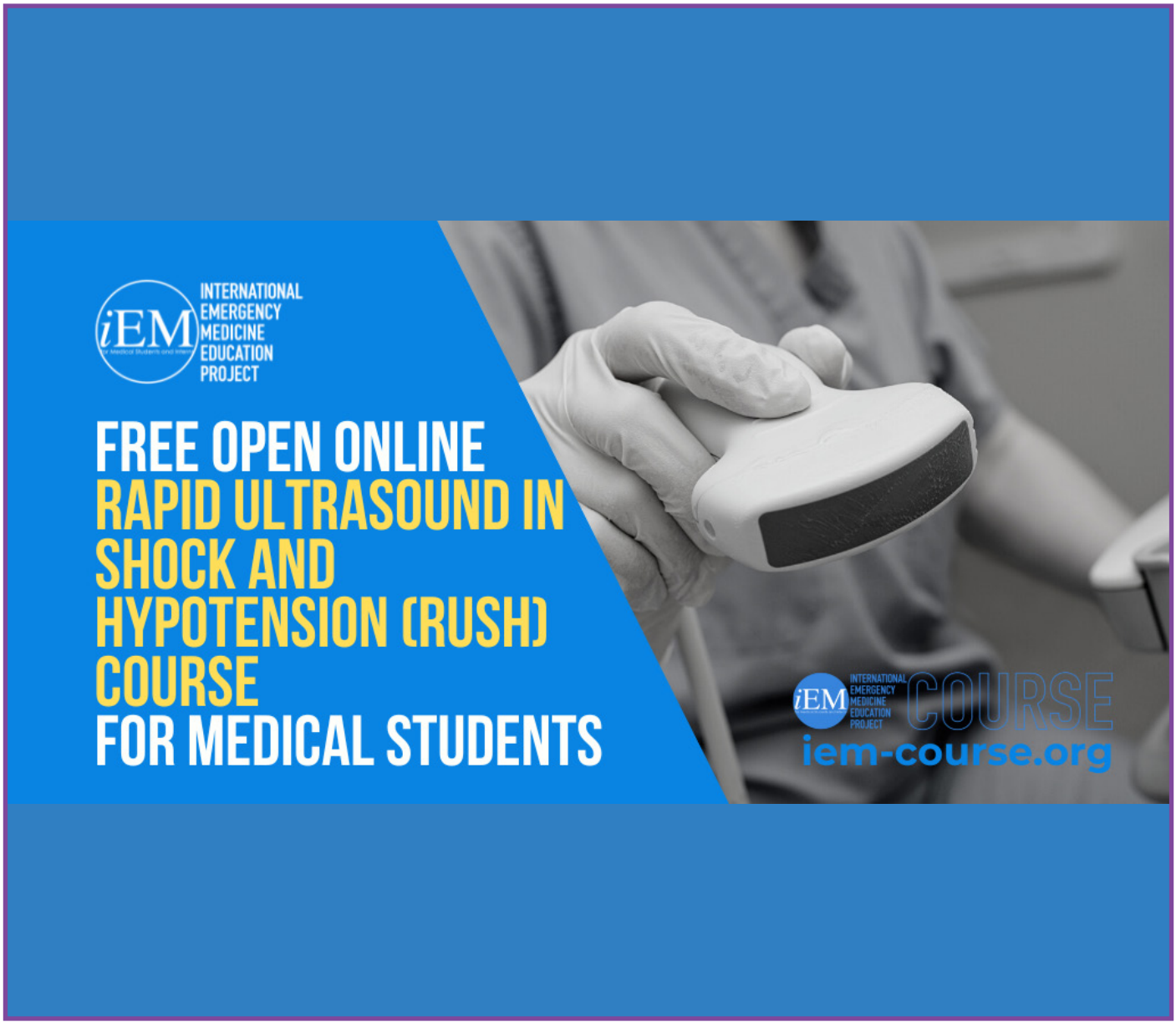
Which of the following is the most likely cause for this patient's condition?

A Pyelonephritis

B Hypovolemic shock

C Distributive shock

D Ureteral stone



Explanation – Question 51

This patient is in a shock state caused by left-sided pyelonephritis. Shock is an emergency medical state characterized by cardiovascular or circulatory failure. Shock prevents peripheral tissues from receiving adequate perfusion, resulting in organ dysfunction and failure. Shock can be categorized as hypovolemic, distributive, obstructive, or cardiogenic. The different categories of shock are defined by their underlying cause (i.e., sepsis, hemorrhage, pulmonary embolism, etc.) and their hemodynamics which sometimes overlap. The diagnosis of shock is largely clinical and supported by the history, vital signs, and physical exam. Additional studies, such as laboratory investigations, bedside ultrasound, and imaging tests help narrow down the type of shock, potential triggers, and guide management. The chart below details the categories of shock, each category's hemodynamics, potential causes, and treatments.

Type of Shock	Hemodynamics	Potential Causes	Potential Treatments
Hypovolemic	↓preload ↑SVR ↓CO	Dehydration, vomiting/diarrhea, burns, hemorrhage (GI bleed, traumatic wound, etc.)	IV fluids Blood products (if due to hemorrhage)
Distributive	↓preload ↓SVR ↓/↑CO	Sepsis, anaphylaxis, adrenal insufficiency, neurogenic shock	IV fluids +/- antibiotics and vasopressors. Treat underlying cause. • Epinephrine (anaphylaxis) • Norepinephrine (sepsis or neurogenic) • Phenylephrine (neurogenic)
Cardiogenic	↑preload ↑SVR ↓CO	Heart failure, arrythmias, myocardial infarction, valve failure, myocarditis, cardiomyopathy	Dobutamine or Epinephrine Treat underlying cause
Obstructive	↓preload ↑SVR ↓CO	Tension pneumothorax, cardiac tamponade, pulmonary embolism	IV fluids Treat underlying cause. Tension Pneumothorax: • Needle decompression then tube thoracostomy Cardiac tamponade: • Pericardiocentesis then pericardial window Pulmonary embolism: • Anticoagulation, consider thrombolytics or surgical embolectomy

SVR: Systemic Vascular Resistance, CO: Cardiac Output

The patient's signs, symptoms, physical exam, and urine studies point towards an infectious etiology. This patient is in septic shock, which is considered a type of distributive shock **(Choice B)**. Hypovolemic shock (Choice A), obstructive shock (Choice C), and cardiogenic shock (Choice D) are caused by other conditions reflected in the above table.

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- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
- Richards JB & Wilcox SR. (2014). Diagnosis and management of shock in the Emergency department. EB Medicine, 16(3), 1-24. Retrieved from https://www.cmua.nl/Cmua/Inwerken_files/0314%20Shock.pdf

Explanation – Question 52

This patient has anaphylactic shock, which falls under the category of distributive shock. Anaphylactic shock is an acutely life-threatening type of allergic reaction. If left untreated, it can progress to airway edema, asphyxiation, and death. Exposure to a known or unknown allergen is the trigger for anaphylaxis. Diagnosis of this condition requires the below criteria to be met:

1. Acute onset of skin or mucosal changes (i.e., urticaria, tongue or lip swelling) AND hypotension or respiratory compromise (i.e., wheezing). **OR**
2. Dysfunction of two or more body systems after exposure to a presumed allergen:
   - Skin/mucosa (i.e., urticaria, swelling of tongue or lips)
   - Pulmonary (i.e., wheezing)
   - Cardiovascular (i.e., hypotension)
   - Gastrointestinal (i.e., vomiting or diarrhea)
   - End-organ dysfunction

Management of anaphylaxis requires proper evaluation of the patient's airway, respiratory status, and hemodynamics ("ABCs"). The mainstays of therapy are intramuscular epinephrine (0.3mg in adults) and IV hydration. Administration of epinephrine is a time-sensitive and life-saving intervention. Antihistamines, nebulized albuterol or salbutamol, and steroids are additional therapies that are commonly given. Steroids are thought to prevent recurrent anaphylactic reactions; however, little data supports this. Patients are typically monitored for 4-6 hours after administration of epinephrine to observe changes in clinical status or the need for additional doses of epinephrine. Patients who remain stable or improve after this observation period are able to be discharged home with a prescription for an epinephrine injector in the event of future anaphylaxis episodes.

Intravenous normal saline (Choice A) and diphenhydramine (Choice B) are important therapies to administer in this patient, but intramuscular epinephrine **(Choice C)** is the most time-sensitive initial therapy to administer. Without treatment, airway edema may progress and require endotracheal intubation (Choice D). However, the patient's clear voice and lack of stridor indicate that the patient does not need immediate intubation.

References

- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
- Richards JB & Wilcox SR. (2014). Diagnosis and management of shock in the emergency department. EB Medicine, 16(3), 1-24. Retrieved from https://www.cmua.nl/Cmua/Inwerken_files/0314%20Shock.pdf
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Explanation – Question 53

This patient endured a high-speed motor vehicle accident, arrived with hypotension and bradycardia, and has a C6 vertebral body fracture on imaging. These details support a diagnosis of neurogenic shock, a type of distributive shock.

Shock is an emergency medical state characterized by cardiovascular or circulatory failure. Shock prevents peripheral tissues from receiving adequate perfusion, resulting in organ dysfunction and failure. Shock can be categorized as hypovolemic, distributive, obstructive, or cardiogenic. The different categories of shock are defined by their underlying cause (i.e., sepsis, hemorrhage, pulmonary embolism, etc.) and their hemodynamics which sometimes overlap. The diagnosis of shock is largely clinical and supported by the history, vital signs, and physical exam. Additional studies, such as laboratory investigations, bedside ultrasound, and imaging tests help narrow down the type of shock, potential triggers, and guide management. The chart below details the categories of shock, each category's hemodynamics, potential causes, and treatments.

Type of Shock	Hemodynamics	Potential Causes	Potential Treatments
Hypovolemic	↓preload ↑SVR ↓CO	Dehydration, vomiting/diarrhea, burns, hemorrhage (GI bleed, traumatic wound, etc.)	IV fluids Blood products (if due to hemorrhage)
Distributive	↓preload ↓SVR ↓/↑CO	Sepsis, anaphylaxis, adrenal insufficiency, neurogenic shock	IV fluids +/- antibiotics and vasopressors. Treat underlying cause. • Epinephrine (anaphylaxis) • Norepinephrine (sepsis or neurogenic) • Phenylephrine (neurogenic)
Cardiogenic	↑preload ↑SVR ↓CO	Heart failure, arrythmias, myocardial infarction, valve failure, myocarditis, cardiomyopathy	Dobutamine or Epinephrine Treat underlying cause
Obstructive	↓preload ↑SVR ↓CO	Tension pneumothorax, cardiac tamponade, pulmonary embolism	IV fluids Treat underlying cause. Tension Pneumothorax: • Needle decompression then tube thoracostomy Cardiac tamponade: • Pericardiocentesis then pericardial window Pulmonary embolism: • Anticoagulation, consider thrombolytics or surgical embolectomy

SVR: Systemic Vascular Resistance, CO: Cardiac Output

Neurogenic shock is caused by spinal cord damage above the T6 level. Unlike other types of shock, neurogenic shock is characterized by hypotension and bradycardia (not tachycardia). These vital sign abnormalities are caused by damage to the sympathetic nervous system **(Choice C)**. Neurogenic shock has decreased systemic vascular resistance (warm extremities), not increased systemic vascular

resistance (cool extremities) (Choice A). Occult hemorrhage (Choice B) is always a concern in a trauma patient. However, this would present with findings of hypovolemic/hemorrhagic shock (tachycardia, hypotension, cool extremities). Tension pneumothorax (Choice D) is also unlikely as the patient has clear bilateral lung sounds on physical examination. The best answer is Choice C.

References

- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Nickson C. (2020). Acute traumatic spinal cord injury. Life in the Fast Lane. Retrieved from https://litfl.com/acute-traumatic-spinal-cord-injury/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
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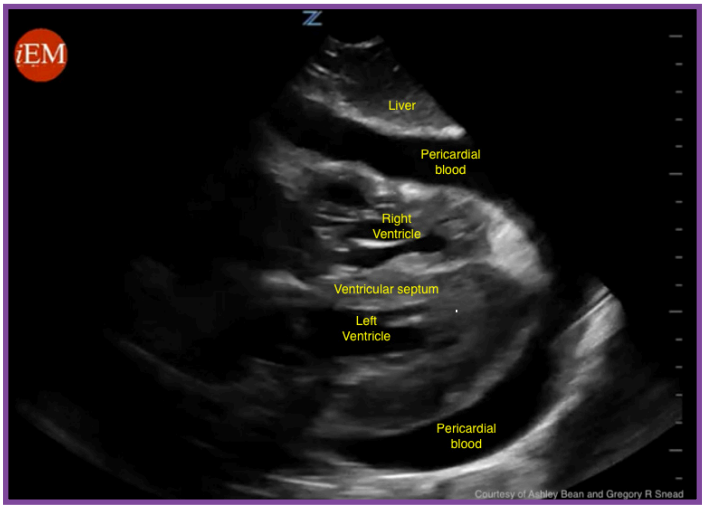
Explanation – Question 54

This patient sustained significant blunt trauma to the chest and presented to the Emergency Department with hypotension, tachycardia, a large chest ecchymosis, and palpable sternal crepitus. The ultrasound image shows a subxiphoid view of the heart with a large pericardial effusion. In the setting of trauma, this should be assumed to be a hemopericardium. This patient has cardiac tamponade, which is considered a type of obstructive shock **(Choice C)**. Treatment includes IV hydration to increase preload, bedside pericardiocentesis, and ultimately, a surgical cardiac window performed by cardiothoracic surgery. The other shock types (Choices A, B, and D) do not describe this patient's presentation. Please see the chart on the page 99 for further description of the different shock types and therapies.



References

- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
- Richards JB & Wilcox SR. (2014). Diagnosis and management of shock in the emergency department. EB Medicine, 16(3), 1-24. Retrieved from https://www.cmua.nl/Cmua/Inwerken_files/0314%20Shock.pdf

Explanation – Question 55

This patient presents with chest pressure at rest and an anterior ST-segment elevation myocardial infarction (STEMI) seen on 12-lead EKG. This patient should be given aspirin, IV fluids to increase the preload status, and receive immediate coronary reperfusion therapy. This patient's hypotension is likely due to left ventricle infarction, causing poor cardiac output (Choice D). This is known as cardiogenic shock. The patient has been vomiting, but the acute onset of symptoms and STEMI on EKG make poor cardiac output (Choice D) more likely than hypovolemia (Choice A) as the cause for the patient's condition. Systemic infection (Choice B) and pulmonary embolism (Choice C) are also less likely, given the clinical information in the case and the STEMI on EKG. Therefore, the best answer is Choice D. Please see the chart below for further details of the different types of shock.

Type of Shock	Hemodynamics	Potential Causes	Potential Treatments
Hypovolemic	↓preload ↑SVR ↓CO	Dehydration, vomiting/diarrhea, burns, hemorrhage (GI bleed, traumatic wound, etc.)	IV fluids Blood products (if due to hemorrhage)
Distributive	↓preload ↓SVR ↓/↑CO	Sepsis, anaphylaxis, adrenal insufficiency, neurogenic shock	IV fluids +/- antibiotics and vasopressors. Treat underlying cause. • Epinephrine (anaphylaxis) • Norepinephrine (sepsis or neurogenic) • Phenylephrine (neurogenic)
Cardiogenic	↑preload ↑SVR ↓CO	Heart failure, arrythmias, myocardial infarction, valve failure, myocarditis, cardiomyopathy	Dobutamine or Epinephrine Treat underlying cause
Obstructive	↓preload ↑SVR ↓CO	Tension pneumothorax, cardiac tamponade, pulmonary embolism	IV fluids Treat underlying cause. Tension Pneumothorax: • Needle decompression then tube thoracostomy Cardiac tamponade: • Pericardiocentesis then pericardial window Pulmonary embolism: • Anticoagulation, consider thrombolytics or surgical embolectomy

SVR: Systemic Vascular Resistance, CO: Cardiac Output

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- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
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Explanation – Question 56

This trauma patient arrives with hypotension, tachycardia, absent unilateral lung sounds, and distended neck veins. This should raise serious concern for tension pneumothorax, a type of obstructive shock **(Choice C)**. This diagnosis should be made clinically without X-ray imaging. Bedside ultrasound can assist in making the diagnosis by looking for bilateral lung sliding, if available. Treatment of tension pneumothorax should be prompt and includes needle decompression followed by tube thoracostomy. Other types of shock outlined in Choices A, B, and D do not fit the clinical scenario with the given information.

Recall that shock is an emergency medical state characterized by cardiovascular or circulatory failure. Shock prevents peripheral tissues from receiving adequate perfusion, resulting in organ dysfunction and failure. Shock can be categorized as hypovolemic, distributive, obstructive, or cardiogenic. The different categories of shock are defined by their underlying cause (i.e., sepsis, hemorrhage, pulmonary embolism, etc.) and their hemodynamics which sometimes overlap. The diagnosis of shock is largely clinical and supported by the history, vital signs, and physical exam. Additional studies, such as laboratory investigations, bedside ultrasound, and imaging tests help narrow down the type of shock, potential triggers, and guide management. The chart on the page 101 provides details the categories of shock, each category's hemodynamics, potential causes, and treatments.

References

- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
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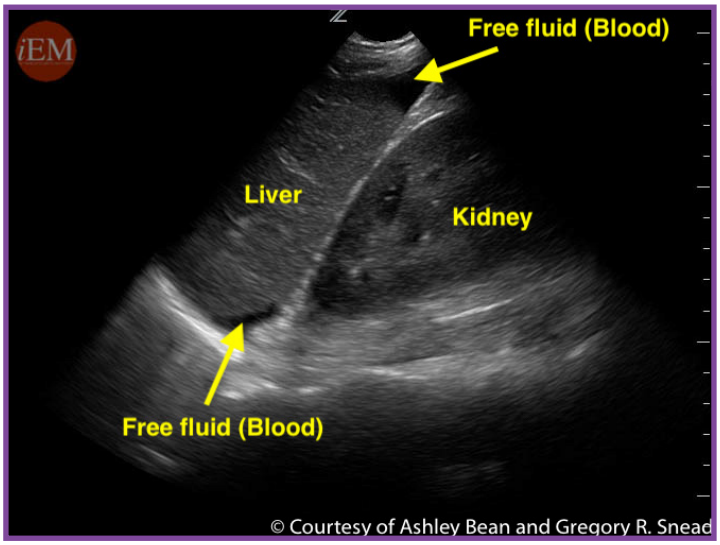
Explanation – Question 57

This young female presents with dizziness, fatigue, nausea, generalized abdominal pain, hypotension, tachycardia, and a positive urine pregnancy test. The anechoic (black) areas on the bedside ultrasound indicate free fluid (blood) in the peritoneal space. See the image for clarification.This patient is in a state of physiologic shock. Shock is an emergency medical state characterized by cardiovascular or circulatory failure. Shock prevents peripheral tissues from receiving adequate perfusion, resulting in organ dysfunction and failure. Shock can be cat-



egorized as hypovolemic, distributive, obstructive, or cardiogenic. The different categories of shock are defined by their underlying cause (i.e., sepsis, hemorrhage, pulmonary embolism, etc.) and their hemodynamics which sometimes overlap. The diagnosis of shock is largely clinical and supported by the history, vital signs, and physical exam. Additional studies, such as laboratory investigations, bedside ultrasound, and imaging tests help narrow down the type of shock, potential triggers, and guide management. This patient's condition is caused by a presumed ruptured ectopic pregnancy and intraperitoneal bleeding. This is considered hypovolemic/hemorrhagic shock **(Choice A)**. The other types of shock in Choices B, C, and D are less likely given the clinical and diagnostic information in the case. The chart below details the categories of shock, each category's hemodynamics, potential causes, and treatments.

Type of Shock	Hemodynamics	Potential Causes	Potential Treatments
Hypovolemic	↓preload ↑SVR ↓CO	Dehydration, vomiting/diarrhea, burns, hemorrhage (GI bleed, traumatic wound, etc.)	IV fluids Blood products (if due to hemorrhage)
Distributive	↓preload ↓SVR ↓/↑CO	Sepsis, anaphylaxis, adrenal insufficiency, neurogenic shock	IV fluids +/- antibiotics and vasopressors. Treat underlying cause. • Epinephrine (anaphylaxis) • Norepinephrine (sepsis or neurogenic) • Phenylephrine (neurogenic)
Cardiogenic	↑preload ↑SVR ↓CO	Heart failure, arrythmias, myocardial infarction, valve failure, myocarditis, cardiomyopathy	Dobutamine or Epinephrine Treat underlying cause
Obstructive	↓preload ↑SVR ↓CO	Tension pneumothorax, cardiac tamponade, pulmonary embolism	IV fluids Treat underlying cause. Tension Pneumothorax: • Needle decompression then tube thoracostomy Cardiac tamponade: • Pericardiocentesis then pericardial window Pulmonary embolism: • Anticoagulation, consider thrombolytics or surgical embolectomy

SVR: Systemic Vascular Resistance, CO: Cardiac Output

References

- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
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Explanation – Question 58

This cirrhotic patient presents to the Emergency Department with epigastric pain after an episode of hematemesis at home. His initial vital signs are within normal limits. While waiting in the Emergency Department, his clinical status changes. The patient has a large volume of hematemesis with hypotension and tachycardia. This patient is now in hemorrhagic shock from an upper gastrointestinal bleed and requires immediate volume resuscitation. The most common cause of upper gastrointestinal bleeding is peptic ulcer disease, but this patient's cirrhosis history and large volume of hematemesis should raise concern for an esophageal variceal bleed. IV Pantoprazole (Choice D) is a proton pump inhibitor that helps reduce bleeding in peptic ulcers, but it does not provide benefits in esophageal varices. Volume repletion is also a more important initial step than giving pantoprazole. IV Ceftriaxone (Choice C) helps reduce the likelihood of infectious complications in variceal bleed patients. This has a mortality benefit and is a recommended adjunctive treatment. However, rapid volume resuscitation is a more important initial step. IV crystalloid fluids, like normal saline (Choice A), are helpful in patients with hypovolemic shock (i.e., dehydration, vomiting), distributive shock (i.e., sepsis, anaphylaxis), and obstructive shock (i.e., tension pneumothorax, etc.). Hypovolemic shock due to severe hemorrhage (hemorrhagic shock) requires blood products, not crystalloid fluids, which can further dilute blood and cause coagulopathy. Administration of packed red blood cells **(Choice B)** is the best next step in management in this case.

References

- Long, B. (2018). EM@3AM: Gastroesophageal varices. EmDocs. Retrieved from http://www.emdocs.net/em3am-gastroesophageal-varices/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
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Explanation – Question 59

This patient presents to the Emergency Department with palpitations, generalized weakness, and shortness of breath after discontinuing all her home medications. She has hypotension, marked tachycardia, and pulmonary edema (crackles on lung auscultation). The 12-lead EKG demonstrates atrial fibrillation with a rapid ventricular rate. This patient is in a state of cardiogenic shock and requires prompt oxygen support, blood pressure support, and heart rate control.

Pulmonary embolism (Choice A) can sometimes manifest as new atrial fibrillation with shortness of breath and tachycardia, but pulmonary embolism initially causes obstructive shock. If a pulmonary embolism goes untreated, it can progress to right ventricular failure, pulmonary edema, and cardiogenic shock. This patient has known atrial fibrillation and stopped all her home medications. The abrupt medication change is a more likely cause of the patient's cardiogenic shock. Dehydration (Choice D) and systemic infection (Choice D) are less likely given the above history of abruptly stopping home maintenance medications. Untreated cardiac arrhythmia **(Choice B)** is the most likely cause of this patient's pulmonary edema and cardiogenic shock.

The chart below details the categories of shock, each category's hemodynamics, potential causes, and treatments.

Type of Shock	Hemodynamics	Potential Causes	Potential Treatments
Hypovolemic	↓preload ↑SVR ↓CO	Dehydration, vomiting/diarrhea, burns, hemorrhage (GI bleed, traumatic wound, etc.)	IV fluids Blood products (if due to hemorrhage)
Distributive	↓preload ↓SVR ↓/↑CO	Sepsis, anaphylaxis, adrenal insufficiency, neurogenic shock	IV fluids +/- antibiotics and vasopressors. Treat underlying cause. • Epinephrine (anaphylaxis) • Norepinephrine (sepsis or neurogenic) • Phenylephrine (neurogenic)
Cardiogenic	↑preload ↑SVR ↓CO	Heart failure, arrythmias, myocardial infarction, valve failure, myocarditis, cardiomyopathy	Dobutamine or Epinephrine Treat underlying cause
Obstructive	↓preload ↑SVR ↓CO	Tension pneumothorax, cardiac tamponade, pulmonary embolism	IV fluids Treat underlying cause. Tension Pneumothorax: • Needle decompression then tube thoracostomy Cardiac tamponade: • Pericardiocentesis then pericardial window Pulmonary embolism: • Anticoagulation, consider thrombolytics or surgical embolectomy

SVR: Systemic Vascular Resistance, CO: Cardiac Output

References

- Morgenstern J. (2015). An approach to undifferentiated hypotension. First10EM. Retrieved from https://first10em.com/undifferentiated-hypotension/
- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
- Richards JB & Wilcox SR. (2014). Diagnosis and management of shock in the emergency department. EB Medicine, 16(3), 1-24. Retrieved from https://www.cmua.nl/Cmua/Inwerken_files/0314%20Shock.pdf

Explanation – Question 60

This first-trimester pregnant patient presents with generalized weakness, nausea, and vomiting. She is hypotensive and tachycardic with no sign of urinary infection on the urinalysis. The many ketones in the urine indicate the patient has inadequate oral nutrition and is breaking down muscle and adipose tissue for energy. This is likely related to the persistent vomiting the patient is experiencing. This patient has hyperemesis, a common condition in the first trimester of pregnancy that is caused by rising levels of beta-human chorionic gonadotropin (BHCG). Treatment for this patient should include IV hydration and antiemetics. Admission criteria for these patients includes intractable vomiting despite antiemetic administration, over 10% maternal weight loss, persistent ketone or electrolyte abnormalities despite rehydration, or uncertainty in the diagnosis.

The fluid losses caused by vomiting in this condition result in hypovolemic shock **(Choice B)**. Distributive shock (Choice C) is caused by other conditions, like sepsis, anaphylaxis, and neurogenic shock. A ureteral stone (Choice D) is unlikely as the patient reports no abdominal, back, or flank pain. The urinalysis also does not show any hematuria, a common sign of a ureteral stone. Pyelonephritis (Choice A) can cause vomiting and septic shock, resulting in hypotension and tachycardia. However, there is no sign of infection in the urinalysis provided, no fever, and no back or flank pain. Therefore, the best answer is choice B.

References

- Pickens, A. (2018). EM in 5: Shock. EMDocs. Retrieved from http://www.emdocs.net/em-in-5-shock/
- Richards JB & Wilcox SR. (2014). Diagnosis and management of shock in the emergency Department. EB Medicine, 16(3), 1-24. Retrieved from https://www.cmua.nl/Cmua/Inwerken_files/0314%20Shock.pdf
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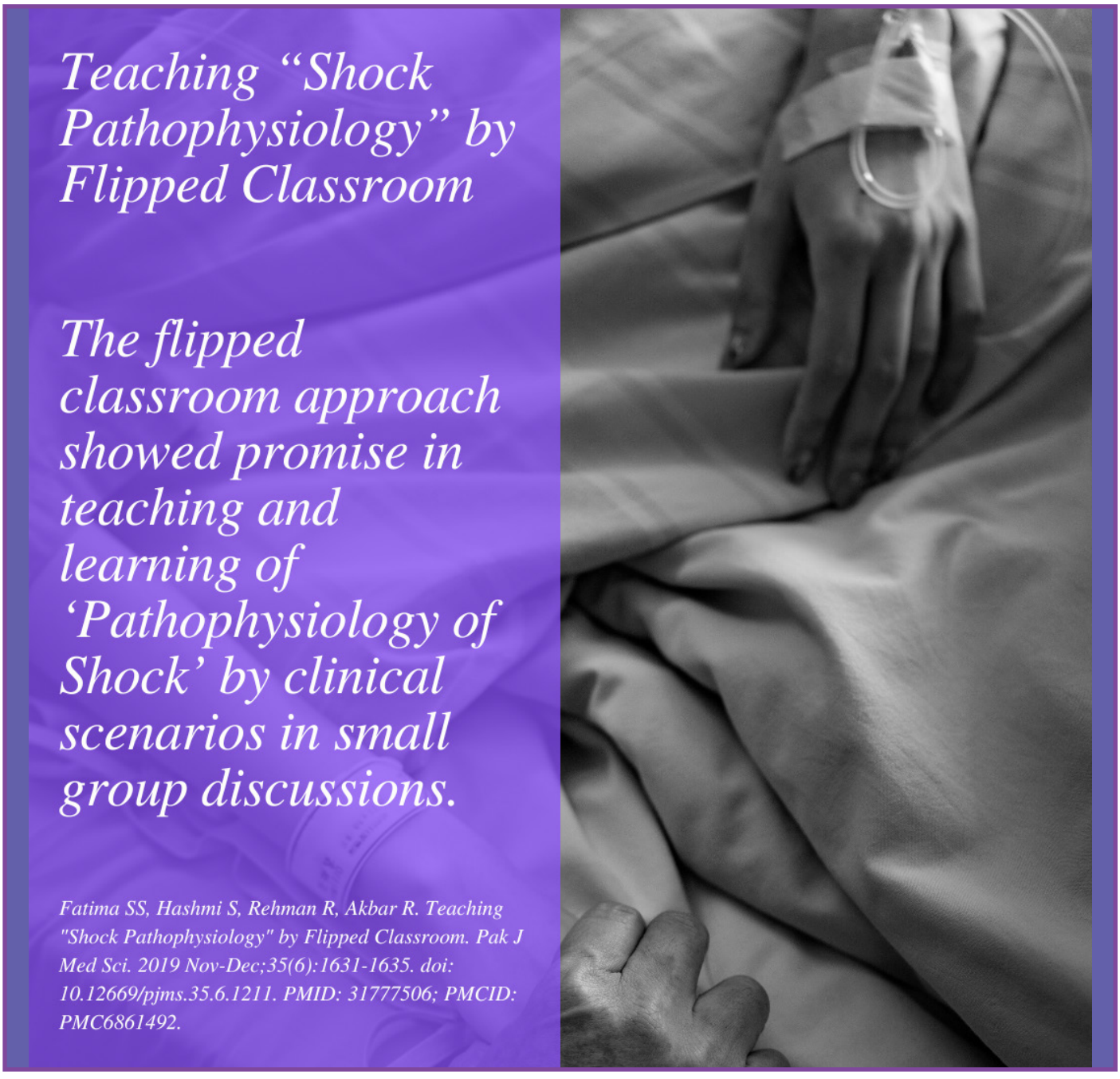

Teaching "Shock Pathophysiology" by Flipped Classroom
The flipped classroom approach showed promise in teaching and learning of 'Pathophysiology of Shock' by clinical scenarios in small group discussions.
Fatima SS, Hashmi S, Rehman R, Akbar R. Teaching "Shock Pathophysiology" by Flipped Classroom. Pak J Med Sci. 2019 Nov-Dec;35(6):1631-1635. doi: 10.12669/pjms.35.6.1211. PMID: 31777506; PMCID: PMC6861492.

Question 61

A 28-year-old man presents to the Emergency Department complaining of right-sided chest pain after a physical altercation with a family member. The patient states he was stabbed with a knife multiple times in the right chest immediately prior to arrival. He denies sustaining trauma to other parts of his body. The patient has no past medical or surgical history. On examination, his temperature is 37°C, blood pressure 88/40 mmHg, pulse 125 beats/min, respiratory rate 26 breaths/min, and oxygen saturation is 91% on room air. The patient is awake and alert but shows significant pain. His airway is patent, and he speaks with a clear voice.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Administer packed red blood cells

B. Auscultate both lungs

C. Remove the patient's clothes to evaluate for occult injuries

D. Perform a FAST exam (Focused Assessment with Sonography in Trauma)

Question 62

A 62-year-old unidentified man presents to the Emergency Department after a high-speed motor vehicle accident. The patient was an unrestrained driver in a vehicle that was hit in a head-on collision. Bystanders report that the patient's vehicle rolled over multiple times and hit a tree at the scene. The patient's past medical history is unknown. On examination, his temperature is 37°C, blood pressure 150/40 mmHg, pulse 115 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The patient is somnolent but responsive to pain. A head CT scan without contrast is performed and is shown below.

Which of the following is the most likely diagnosis for this patient's condition?

A. Subdural hemorrhage

B. Intraparenchymal hemorrhage

C. Epidural hemorrhage

D. Subarachnoid hemorrhage

Question 63

A 55-year-old man presents to the Emergency Department after a high-speed motor vehicle accident. The patient was a restrained driver that drove head-on into a tree. The driver-side airbags were deployed, and the glass windshield was damaged. The patient was able to walk at the scene and self-extricate himself from the vehicle. The patient's wife says that prior to the car accident, he had been drinking alcohol throughout the evening. On examination, his temperature is 37°C, blood pressure 150/90 mmHg, pulse 87 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 98% on room air. The patient smells of alcohol and has slurred speech. His airway is patent, lungs are clear bilaterally, pulses in all extremities are equal, and the patient is mildly confused with a GCS of 14. A FAST exam shows no evidence of free intraperitoneal fluid or signs of cardiac tamponade. There are no physical signs of trauma other than mild skin abrasions on the hands.

Which of the following is the most appropriate next step in management for this patient's condition?

A CT scan of the head and cervical spine without contrast

B CT scan of the head without contrast only

C Endotracheal intubation

D Neurosurgical consultation

Question 64

A 24-year-old man presents to the Emergency Department after an assault with blunt trauma to the abdomen. The patient says he was walking home at night when he was attacked by an unknown person who asked for his money. The patient was kicked multiple times in the abdomen and now complains of generalized weakness and left flank pain. On examination, his temperature is 37°C, blood pressure 85/40 mmHg, pulse 135 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 97% on room air. He appears pale and weak. Large-bore peripheral IV lines are placed, and 1 Liter of normal saline is initiated. Packed red blood cells are ordered from the blood bank. A Focused Assessment with Sonography in Trauma (FAST) exam is conducted with the left upper quadrant view shown below.

Which of the following is the most appropriate next step in management?

A CT scan of the chest, abdomen, and pelvis

B Exploratory laparotomy

C CT scan of the head

D Bedside diagnostic peritoneal lavage (DPL)

Question 65

A 35-year-old woman presents to the Emergency Department after an assault with penetrating trauma to the abdomen. The patient says she was stabbed with a sharp object in the mid-abdomen while walking through a dark alleyway. She has generalized abdominal discomfort but no other symptoms. On examination, her temperature is 37°C, blood pressure 105/65 mmHg, pulse 98 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The abdomen has a 2 cm laceration above the umbilicus with no active bleeding. Large-bore peripheral IV lines are placed, and 1 Liter of normal saline fluid is started. A Focused Assessment with Sonography in Trauma (FAST) exam is conducted with the right upper quadrant view shown below. Assume all other FAST exam views are nonremarkable.

Which of the following is the most appropriate next step in management for this patient's condition?

A Exploratory laparotomy

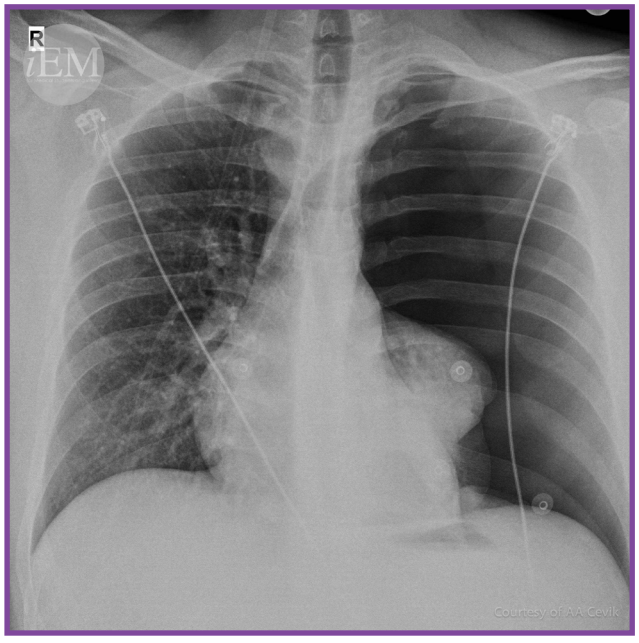
B Packed red blood cell infusion

C CT scan of the abdomen and pelvis

D Urinalysis to check for hematuria

Question 66

A 29-year-old man presents to the Emergency Department after sustaining a stab wound to the left upper chest prior to arrival. He is complaining of pleuritic chest pain and shortness of breath. On examination, his temperature is 37°C, blood pressure 125/80 mmHg, pulse 95 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 92% on room air. The airway is patent, and pulses are equal in all distal extremities. There is a 1 cm laceration in the anterior axillary line at the 4th intercostal space with no active bleeding. A bedside chest X-ray is performed and shown below.



Which of the following is the most diagnosis of this patient's condition?

A Hemorrhagic shock

B Traumatic tension pneumothorax

C Cardiac tamponade

D Traumatic non-tension pneumothorax

Question #67

A 31-year-old man presents to the Emergency Department after sustaining a stab wound to the left chest prior to arrival. He is complaining of pleuritic chest pain and shortness of breath. On examination, his temperature is 37°C, blood pressure 80/40 mmHg, pulse 125 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 92% on room air. The airway is patent, and pulses are equal in all distal extremities. Lung sounds are diminished on the left, but the tracheal is midline. Large-bore peripheral IV lines are placed, and a normal saline fluid bolus is initiated. A FAST exam is performed with the subxiphoid (cardiac) view shown below.

Which of the following is the most likely cause for this patient's condition?

A. High cardiac preload
B. Low cardiac afterload
C. Low cardiac output
D. High cardiac output

Question 68

A 73-year-old man presents to the Emergency Department after a slip and fall down five stairs. The patient was able to ambulate after the fall without hip or lower extremity pain. He complains of left flank pain and denies chest pain, shortness of breath, headache, or neck pain. His medical history includes atrial fibrillation on warfarin, hypertension, and diabetes. On examination, his temperature is 37°C, blood pressure 145/90 mmHg, pulse 98 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The airway is patent, and pulses are equal in all distal extremities. Lung sounds are clear and equal bilaterally. There is tenderness and ecchymoses over the posterior left lower ribs. A bedside chest X-ray demonstrates minimally displaced fractures of left ribs #9-11.

Which of the following is the most appropriate next step in management?

A. Admit to the hospital for pain management
B. CT scan of the chest, abdomen, and pelvis
C. Placement of chest tube
D. Incentive spirometry

Question 69

A 16-year-old boy presents to the Emergency Department with a penetrating left neck injury after a slip and fall onto a fish while boating. The fish was caught earlier in the day prior to the incident. The fish has not been removed from the patient as the medical staff on the boat instructed the patient to leave the fish intact. On examination, his temperature is 37°C, blood pressure 118/70 mmHg, pulse 84 beats/min, respiratory rate 25 breaths/min, and oxygen saturation is 98% on room air. The patient has a hoarse voice with no blood noted in the mouth. No active external bleeding is noted from the injury, but air bubbles from the wound when the patient speaks or breathes. An image of the patient is shown.

Which of the following is the most appropriate next step in management for this patient's condition?

A CT angiography scan of the neck

B Remove the fish

C Emergent operative management

D Endotracheal intubation

Question 70

A 36-year-old man presents to the Emergency Department after a suicide attempt in where he cut his right forearm with a kitchen knife. The patient was found 1 hour ago at home by family lying in a pool of blood. The family wrapped multiple shirts around the wounds to control the bleeding but stated that the shirts quickly became saturated with blood. On examination, his temperature is 37°C, blood pressure 80/40 mmHg, pulse 140 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The patient is somnolent but able to answer questions appropriately and follow commands. The airway is patent. The lungs are clear to auscultation bilaterally. Large-bore peripheral IV lines are placed in the left arm. The right forearm wound is profusely bleeding with a pulsatile flow. Direct pressure is applied to the bleeding site for 15 minutes without control of hemorrhage. An image of the wound is below.

Which of the following is the most appropriate next step in management?

A Apply topical tranexamic acid (TXA)

B Inject subcutaneous lidocaine with epinephrine in the site

C Check a serum toxicology screen

D Apply a tourniquet

Explanation – Question 61

This patient arrives to the hospital after penetrating trauma to the right chest. His initial examination reveals hypotension, tachycardia, tachypnea, and low oxygen saturation. All medical and trauma patients arriving at the Emergency Department, especially those who are ill-appearing or with abnormal vital signs, should undergo the "ABCs". This is also known as the primary survey. The primary survey aims to create a step-wise initial approach to patients where all life-threatening conditions are identified and treated early in the encounter with the patient. Therefore, the primary survey should be conducted prior to taking a full history. In trauma patients, the primary survey is extended to include the "ABCDEFs". This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam. Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition.

Airway assessment involves checking for airway patency (clear voice, stridor, blood or vomitus in mouth, etc.) and applying cervical spine immobilization if needed. Endotracheal intubation or a surgical airway may need to be placed during this step. Breathing assessment involves auscultation of the lungs, checking the oxygen saturation, and providing supplemental oxygen to the patient if needed. Abnormalities in the breathing exam (absent unilateral lung sounds, tracheal deviation, etc.) may prompt the placement of a chest tube or needle decompression. During the breathing step, a pneumothorax, tension pneumothorax, or hemothorax is identified and treated. Circulation assessment involves checking the heart rate and blood pressure, palpating all peripheral pulses, establishing IV access, and administering IV fluids or blood products. During the circulation step, haemorrhage and shock are identified and controlled (pressure dressing applied to bleeding extremity wound, tourniquet applied to slow bleeding at amputated limb, etc.). Disability assessment involves checking the patient's neurologic status. This involves calculating a GCS (Glasgow Coma Score), measuring the patient's glucose level, and performing a focused neurologic exam. Exposure involves removing the patient's clothes, which may obstruct the view of other injuries. This step involves rolling the patient to the lateral decubitus position to check the back and perineal areas for trauma. The last step of the primary survey in trauma is the FAST exam (Focused Assessment with Sonography in Trauma). The FAST exam is a quick sonographic exam that requires the practitioner to look at four anatomical areas for signs of internal injuries. The four areas are the right upper abdominal quadrant, left upper abdominal quadrant, pelvis, and subxiphoid (cardiac) areas. The question stem provides information regarding the patient's airway, which is stated to be patent. Therefore, the next step in the "ABCDEFs" should be the evaluation of 'Breathing'. Administration of packed red blood cells (Choice A) is considered part of the "Circulation" assessment. Removing the patient's clothes to evaluate for occult injuries (Choice C) is important, but the "Breathing" assessment should be performed prior to the patient's "Exposure" step. Performing a FAST exam (Choice D) is also an important part of the primary survey, but it should be performed after the "Breathing" step is completed. Auscultation of both lungs **(Choice B)** is the best next step, as this is part of the "Breathing" step after the "Airway" assessment. During this step, the patient should be given supplemental oxygen and evaluated for abnormal or absent unilateral lung sounds. This is important as this patient is at risk for a large pneumothorax, tension pneumothorax, or hemothorax after his penetrating trauma.

References

- American College of Surgeons. ABCs of Trauma. https://www.facs.org/-/media/files/education/core-curriculum/trauma_i_initial_eval.ashx
- Avila, J. (2020). E-FAST exam. Core Ultrasound. https://www.coreultrasound.com/efast/

This patient presents to the Emergency Department after a high-speed motor vehicle accident. On examination, he is tachycardic, mildly tachypneic, and has an altered mental status (somnolent). The first step in evaluating this trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history.

After the primary survey, a more detailed physical exam (secondary survey) is conducted, followed by interventions and focused patient history. A non-contrast CT scan of the head is a reasonable test for this patient, given his significant mechanism of injury and altered mental status on physical examination. The CT scan shows a hyperdense (white) biconvex area on the right side of the brain. This white area indicates the presence of fresh blood on the CT scan. Keep in mind that CT scans are read as if you are looking up from the patient's feet to their head. This means left-right directionality is reversed. See the image below.

A hyperdense area with a sickled or crescent-shaped appearance would indicate an acute subdural hemorrhage (Choice A). This is caused by tearing of the cerebral bridging veins. Hyperdense areas throughout the brain tissue itself would indicate an intraparenchymal hemorrhage (Choice B). Hyperdense areas around the sulci of the brain and a starfish appearance would indicate a subarachnoid hemorrhage (Choice D). Subarachnoid bleeding is caused by rupturing of a brain aneurysm or an arteriovenous (AV) malformation.

Subarachnoid bleeding can also be associated with trauma. This patient's CT image shows an epidural hemorrhage **(Choice C)**, indicated by the biconvex lens-shaped area of blood. This is caused by tearing of the middle meningeal artery. Treatment of all types of intracranial bleeding involves general supportive care, airway management (i.e., endotracheal intubation for GCS < 8), elevating the head of the bed to 30 degrees to lower intracranial pressure (ICP), managing pain and sedation (lowers ICP), blood pressure maintenance (goal SBP 140-160 mmHg), reversal of coagulopathy, neurosurgical evaluation for possible operative intervention, and providing ICP lowering treatments (mannitol or hypertonic 3% NaCl) when concerned about elevated ICP or brain herniation.

Reference

- Lecturio. (2020). Intracranial hemorrhage: Different types and epidemiology. https://www.lecturio.com/magazine/intercranial-hemorrhage/

Explanation – Question 63

This patient presents to the Emergency Department after a high-speed motor vehicle accident in the setting of alcohol intoxication. On examination, he is intoxicated with a GCS of 14 (normal GCS is 15). The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is conducted, followed by interventions and focused patient history. This patient is intoxicated but is awake with a patent airway.

Endotracheal intubation (Choice C) is not indicated. Neurosurgical consultation (Choice D) is also not indicated at this stage as there is no concrete information to indicate a surgical emergency. CT imaging may demonstrate a cervical spine fracture or intracerebral bleeding, but the question stem does not provide these results. A CT scan of the head without contrast (Choice B) is a reasonable test for this patient, given his significant mechanism of injury and intoxication on physical examination. However, a CT scan of the head and cervical spine **(Choice A)** should be ordered because the patient's intoxication creates an unreliable physical exam. Alcohol intoxication or drug use can alter a patient's ability to sense pain and provide accurate information. The presence of intoxication should always raise awareness for possible occult injuries.

Of note, intoxication and altered mental status are indications to perform a CT scan of the cervical spine based on a well-validated decision-making tool known as the NEXUS criteria (National Emergency X-Radiography Utilization Study). Other criteria on the NEXUS tool that support CT cervical spine imaging are midline spinal tenderness, a focal neurologic deficit, or a distracting injury (i.e., femur fracture). The Canadian C-Spine Rule and CT Head Rule are other validated decision-making tools to help a clinician decide whether to order CT head or cervical spine imaging.

References

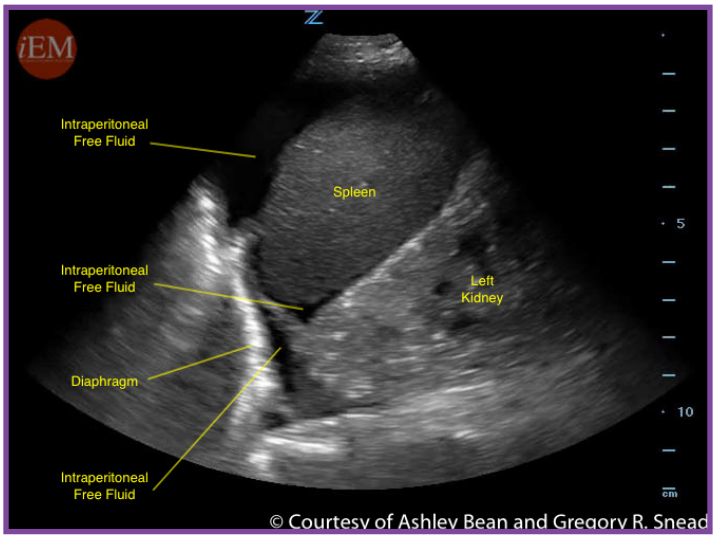
- MDCalc. (2020). Calculated decision support for emergency medicine practice subscribers. https://www.ebmedicine.net/media_library/files/Trauma-Imaging-Resuscitation-CD.pdf
- Lalani, N. (2013). My approach to clearing C-spines. Canadiem. https://canadiem.org/clearing-the-c-spine/

Explanation – Question 64

This patient arrives in the Emergency Department after an assault and has pallor (paleness), hypotension, and tachycardia on physical examination. The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is completed, followed by interventions and focused patient history.

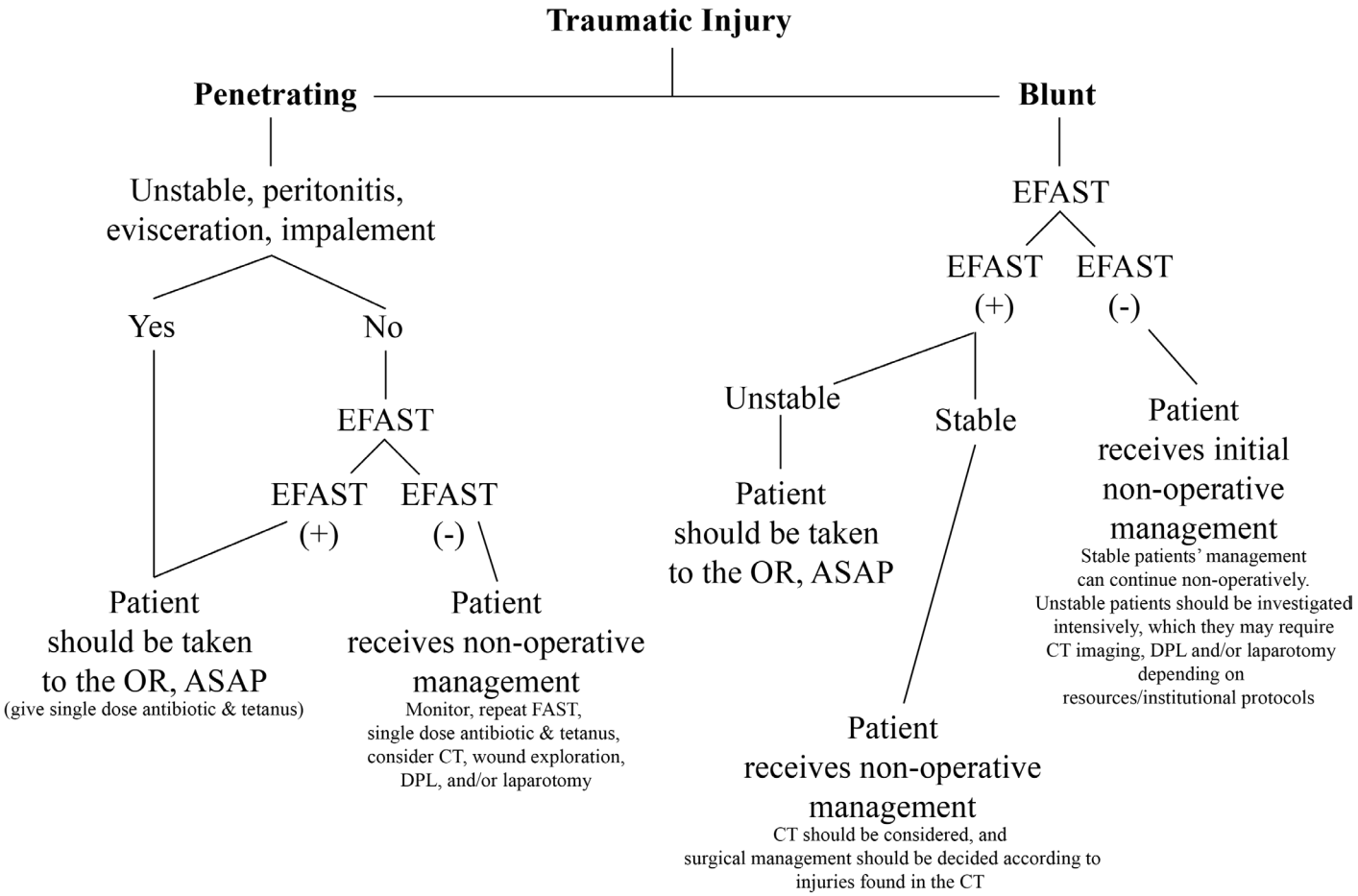
The FAST exam is a quick sonographic exam that requires the practitioner to look at four anatomical areas for signs of internal injuries. The four areas are the right upper abdominal quadrant, left upper

abdominal quadrant, pelvis, and subxiphoid (cardiac) areas. Adding views for each lung (1 view for each lung) is known as an E-FAST or extended FAST exam. The presence of an anechoic (black) stripe on ultrasound indicates the presence of free fluid. In the setting of trauma, free fluid is assumed to be blood. The presence of free fluid on a FAST exam is considered a "positive FAST exam". This patient has free fluid between the left kidney and spleen in combination with hypotension and tachycardia. This patient is in hemorrhagic shock until proven otherwise and needs prompt operative management. See the labelling of the FAST exam image below.



A CT scan of the chest, abdomen, and pelvis (Choice A) and a CT scan of the head (Choice C) may be helpful in the evaluation of this patient, but this patient is hemodynamically unstable. Radiographic tests that require the patient to leave the Emergency Department should be avoided if the patient is unstable. The specific location or cause of the hemodynamic instability can be diagnosed in the operating theater where there are opportunities to control the intraperitoneal bleeding (i.e., splenectomy, vessel ligation or cautery, etc.).

Bedside diagnostic peritoneal lavage (Choice D) is not indicated in penetrating abdominal trauma when there is a negative FAST exam and CT scanning is available. This patient sustained blunt abdominal trauma, so a DPL is less informative. The best next step for this patient is exploratory laparotomy **(Choice B)** in the operating theater. Hemodynamically unstable patients with a positive FAST exam should always go to the operating theater for further diagnosis and treatment. See the algorithm below for further detail.

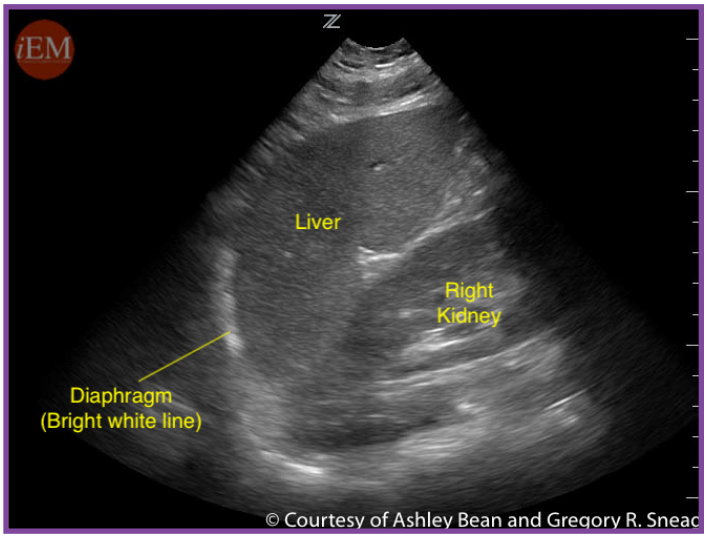

Traumatic Injury
Penetrating
Blunt
Unstable, peritonitis, evisceration, impalement
Yes
No
EFAST
EFAST (+)
EFAST (-)
Patient should be taken to the OR, ASAP
(give single dose antibiotic & tetanus)
Patient receives non-operative management
Monitor, repeat FAST, single dose antibiotic & tetanus, consider CT, wound exploration, DPL, and/or laparotomy
EFAST
EFAST (+)
EFAST (-)
Unstable
Stable
Patient should be taken to the OR, ASAP
Patient receives initial non-operative management
Stable patients' management can continue non-operatively. Unstable patients should be investigated intensively, which they may require CT imaging, DPL and/or laparotomy depending on resources/institutional protocols
Patient receives non-operative management
CT should be considered, and surgical management should be decided according to injuries found in the CT

References

- Avila, J. (2020). E-FAST exam. Core Ultrasound. https://www.coreultrasound.com/efast/
- Gadhok, K, Fairbrother, H. (2015). Abdominal trauma: Is there anything we can be doing better? EmDocs. https://www.emdocs.net/abdominal-trauma-anything-can-better/

Explanation – Question 65

This patient arrives in the Emergency Department after an assault with penetrating abdominal trauma and is hemodynamically stable on physical examination. The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is performed, followed by interventions and focused patient history. The FAST exam is a quick sonographic exam that requires the practitioner to look at four anatomical areas for signs of internal injuries. The four areas are the right upper abdominal quadrant, left upper abdominal quadrant, pelvis, and subxiphoid (cardiac) areas. Adding views for each lung (1 view for each lung) is known as an E-FAST or extended FAST exam. The presence of an anechoic (black) stripe on ultrasound indicates the presence of free fluid. In the setting of trauma, free fluid is assumed to be blood. The presence of free fluid on a FAST exam is considered a "positive FAST exam". This patient has no free fluid between the right kidney and liver. There also is no free fluid above the diaphragm to indicate a hemothorax. The question stem notes that all other FAST exam views are nonremarkable. Therefore, this patient has a negative FAST exam. See the labelling of the FAST exam image below.



An exploratory laparotomy (Choice A) would be indicated in a patient with penetrating or blunt trauma, a positive FAST exam, and hemodynamic instability. This patient has a negative FAST exam and is hemodynamically stable. Packed red blood cell infusion (Choice B) would be indicated in the setting of hemodynamic instability and trauma, as this is assumed to be hemorrhagic shock. This patient is not tachycardic or hypotensive. A urinalysis to check for hematuria (Choice D) may be a helpful adjunctive investigation to evaluate for renal or bladder injury, but it is not the most crucial next step in management. The best next step is performing a CT scan of the abdomen and pelvis **(Choice C)**, as the patient is hemodynamically stable with a negative FAST exam and a penetrating abdominal injury. The CT scan will help further evaluate internal injuries that may require operative repair. See the algorithm on page 116 for further detail on an abdominal trauma workflow.

References

- Avila, J. (2020). E-FAST exam. Core Ultrasound. https://www.coreultrasound.com/efast/
- Gadhok, K, Fairbrother, H. (2015). Abdominal trauma: Is there anything we can be doing better? EmDocs. https://www.emdocs.net/abdominal-trauma-anything-can-better/

Explanation – Question 66

This man presents to the Emergency Department with pleuritic chest pain and shortness of breath after a penetrating chest injury. On physical examination, he has tachypnea and low oxygen saturation, but he is not hypotensive or tachycardic. The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is performed, followed by interventions and focused patient history.

This patient should immediately be given supplemental oxygen for his low oxygen saturation. The history of penetrating chest trauma and hypoxemia should raise concern for a traumatic pneumothorax, and oxygen supplementation is part of the treatment for all pneumothoraces. The patient's chest X-ray shows a large left-sided pneumothorax, indicated by the absence of left-sided lung markings. There is some left-to-right deviation of the heart and the primary bronchi. There is no large left-sided pleural effusion in the costodiaphragmatic recess to indicate a pneumo-hemothorax. There is also no deviation of the trachea, hypotension, or tachycardia to indicate a tension pneumothorax (Choice B). The patient is hemodynamically stable, so he cannot be in hemorrhagic shock (Choice A) or have cardiac tamponade (Choice C). Although the pneumothorax is large with mild deviation of the heart, the lack of hemodynamic instability supports the diagnosis of a traumatic non-tension pneumothorax **(Choice D)**. The treatment for this would include 100% oxygen supplementation and placement of a chest tube. A CT scan of the chest is more sensitive imaging test than a chest X-ray and should be considered to evaluate for additional injuries (blood vessel injuries, rib fractures, etc.).

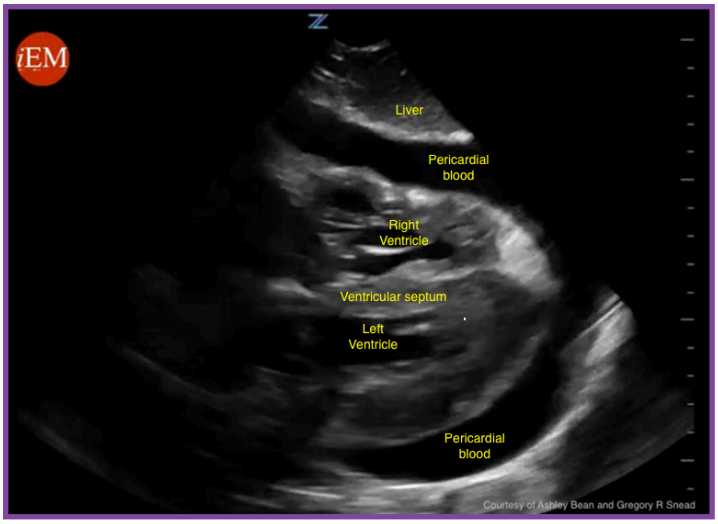
Reference

- Bartels, B. (2020). EM@3AM: Pneumothorax. EMDocs. http://www.emdocs.net/em3am-pneumothorax/

Explanation – Question 67

This patient arrives in the Emergency Department after sustaining penetrating chest trauma and is found to be hypotensive, tachycardic, and with a low oxygen saturation on room air. The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is performed, followed by interventions and focused patient history.

The FAST exam is a quick sonographic exam that requires the practitioner to look at four anatomical areas for signs of internal injuries. The four areas are the right upper abdominal quadrant, left upper abdominal quadrant, pelvis, and subxiphoid (cardiac) areas. Adding views for each lung (1 view for each lung) is known as an E-FAST or extended FAST exam. The presence of an anechoic (black) stripe on ultrasound indicates the presence of free fluid. In the setting of trauma, free fluid is assumed to be blood. The presence of free fluid on a FAST exam is considered a "positive FAST exam". This patient's ultrasound shows fluid in the pericardiac sac, which in combination with the patient's hy-



potension and tachycardia, supports a diagnosis of cardiac tamponade. See the image below for labelling.

Cardiac tamponade is considered a type of obstructive shock. As with other types of obstructive shock, such as pulmonary embolism and tension pneumothorax, there is a state of reduced preload and elevated afterload. This causes a reduction in cardiac output **(Choice C)**, leading to hypotension, tachycardia, and circulatory collapse. High cardiac preload (Choice A), low cardiac afterload (Choice B), and high cardiac output (Choice D) do not occur in cardiac tamponade. Treatment for cardiac tamponade includes IV hydration to increase preload, bedside pericardiocentesis, and a surgical cardiac window performed by cardiothoracic surgery.

References

- Avila, J. (2020). Pericardial tamponade. Core ultrasound. https://www.coreultrasound.com/pericardial-tamponade/
- Simon, E. (2017). EM@3AM – Cardiac tamponade. EmDocs. http://www.emdocs.net/em3am-cardiac-tamponade/

Explanation – Question 68

This elderly man presents to the Emergency Department after a mechanical fall down the stairs with left flank pain. He is on anticoagulation. His chest X-ray shows three lower rib fractures. The diagnosis of rib fractures is clinical in conjunction with imaging. A history of rib trauma with pleuritic chest pain, tenderness over the ribs, and skin ecchymoses over the chest all support a diagnosis of rib fracture. Chest X-ray is often performed as an initial test, but it should be noted that about 50% of rib fractures are not able to be visualized on chest radiography alone. Bedside ultrasonography and CT scanning are more sensitive in detecting rib fractures than plain radiography. Treatment for rib fractures is mainly supportive and includes pain management and incentive spirometry (or regular deep inspiratory breaths) to prevent the development of atelectasis or pneumonia as complications. Many patients with rib fractures can be discharged home with these supportive measures. Another important part of rib fracture management is evaluation for the complications or sequelae of rib fractures. This includes pulmonary contusion, pneumonia, atelectasis, flail chest, traumatic pneumothorax or tension pneumothorax, hemothorax, and abdominal viscus injuries. Elderly patients with multiple rib fractures are more likely to have poor outcomes and should be admitted for close observation. Admission to the hospital for pain management (Choice A) may be needed in this case, but it is not the best next step. Placement of a chest tube (Choice C) is not required in this case as there are no signs of pneumothorax. Incentive spirometry (Choice D) is important to prevent atelectasis or pneumonia, but it is not the best next step. The presence of multiple lower rib fractures (ribs #9-12), as seen in this case, should prompt evaluation for abdominal injuries, such as hepatic or splenic lacerations. Potential abdominal injuries should be of greater concern since this patient is on anticoagulation for atrial fibrillation. The best next step is a CT scan **(Choice B)** to further evaluate for intra-abdominal injuries related to the patient's lower rib fractures.

Reference: Ramzy, M, Hamilton, R. (2018). The chest bump: Pulmonary pearls & pitfalls to consider in patients with chest trauma. EmDocs. http://www.emdocs.net/the-chest-bump-pulmonary-pearls-pitfalls-to-consider-in-patients-with-chest-trauma/

Explanation – Question 69

The neck is a compact anatomical area with many vital structures, including blood vessels that provide oxygen to the brain, the aerodigestive tracts (trachea and esophagus), nerves, and the apices of the lungs. Therefore, a penetrating injury to the neck can be catastrophic and requires prompt examination and appropriate management. The neck is divided into three anatomical zones, which house different anatomical structures. Zone 1 is from the clavicle to the cricoid cartilage, Zone 2 is from the cricoid cartilage to the mandible, and Zone 3 is from the angle of the mandible to the base of the skull. See the reference below for pictures and further descriptions of each zone.

The presence of any "hard signs" of aerodigestive or neurovascular injury should prompt emergent operative management. These "hard signs" include airway compromise, expanding or pulsatile hematoma, active and brisk bleeding, hemorrhagic shock, neurological deficit, massive subcutaneous emphysema, and air bubbling through the wound. If the patient is hemodynamically stable and does not have any of these dangerous "hard signs", it is reasonable to pursue CT angiography of the neck (Choice A) to evaluate for any vascular, aerodigestive, or neurologic injuries. The fish should not be removed (Choice B) in the Emergency department as this may result in uncontrolled bleeding. A more controlled environment, like an operating theater, is a more appropriate setting to remove a penetrating foreign body. The patient, in this case, has two hard signs (bubbling through the wound and airway compromise), so he will need operative management (Choice C). However, the patient's airway compromise is a more emergent and time-sensitive issue that needs to be addressed first with endotracheal intubation **(Choice D)**. Intubation is the next best step in management.

Reference

- Swaminathan, A. (2018). Penetrating neck injuries. REBEL-EM. https://rebelem.com/penetrating-neck-injuries/

Explanation – Question 70

This patient arrives to the hospital after a suicide attempt with multiple bleeding arm wounds, hypotension, tachycardia, and a depressed mental status. This patient is in hemorrhagic shock. The first step in evaluating any trauma patient involves the primary survey. The primary survey is also known as the "ABCDEFs" of trauma. This stands for Airway, Breathing, Circulation, Disability, Exposure, and FAST exam (Focused Assessment with Sonography in Trauma). Each letter should be assessed in alphabetical order to avoid missing a time-sensitive life-threatening condition. The primary survey should be conducted prior to taking a full history. After the primary survey, a more detailed physical exam (secondary survey) is performed, followed by interventions and focused patient history.

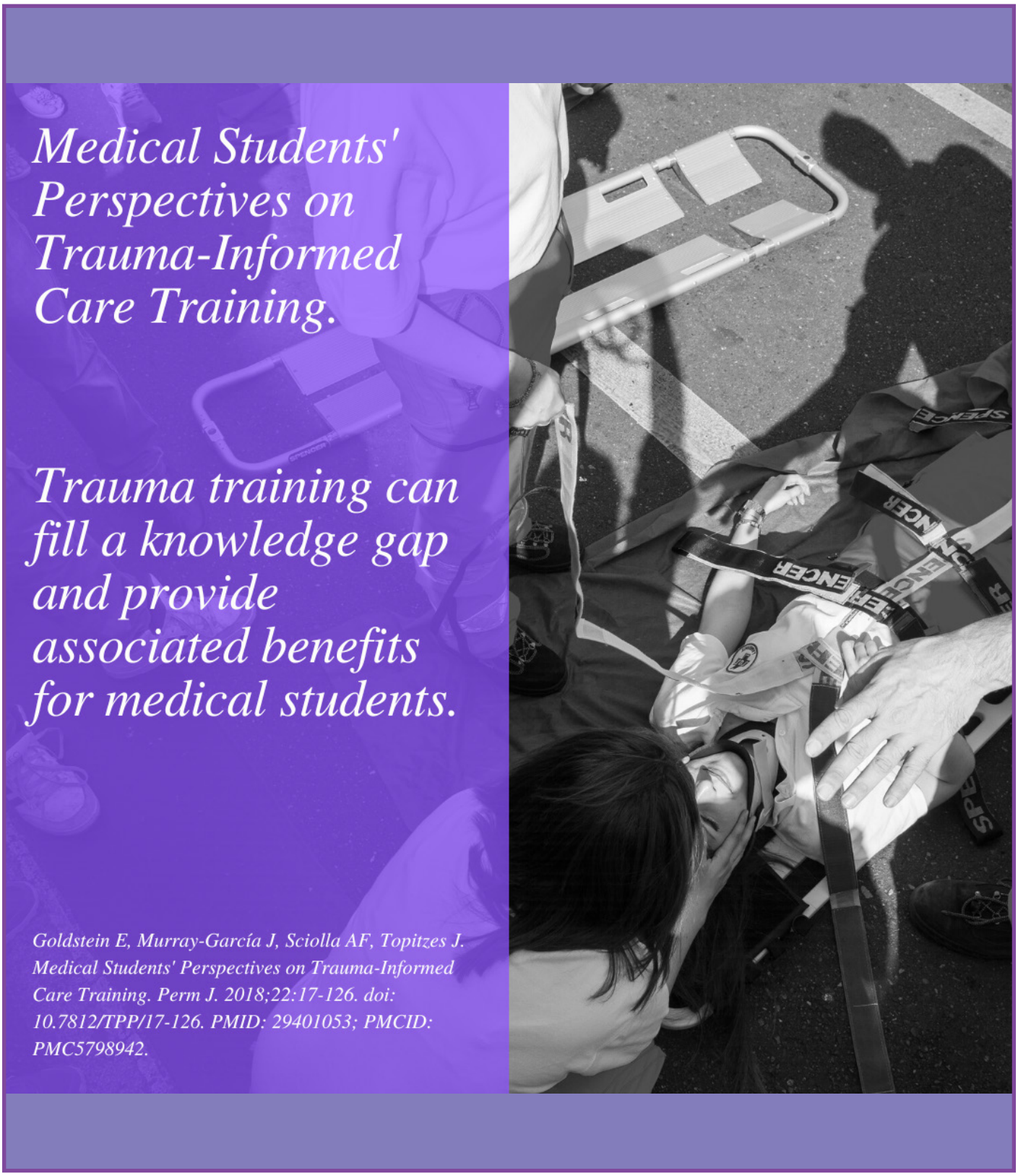
This patient's airway and breathing status have been assessed with no acute issues, as noted in the question stem. On the assessment of the patient's circulation, he is tachycardic, hypotensive, and has an actively bleeding extremity wound. The first step in managing a bleeding wound is to apply constant direct pressure to the site. Direct pressure to the site for 15 minutes should control bleeding in most cases.

If the origin of the bleeding is difficult to identify for direct pressure application, or if direct pressure fails, the next step is to apply a tourniquet **(Choice D)**. If a tourniquet is unavailable, an easy alternative is to use a blood pressure cuff proximal to the bleeding wound and inflate the cuff to 250mmHg or until the bleeding stops. This will allow careful examination and repair of the bleeding wound. Top-

ical tranexamic acid (Choice A) and subcutaneous lidocaine with epinephrine injections (Choice B) can work as adjuncts to tourniquet application. Suturing the area will also help tamponade the bleeding site and aid in clot formation after a tourniquet is applied. Checking a serum toxicology screen (Choice C) may be helpful to evaluate for a concurrent overdose, but this is not as important as initial hemorrhage management. Other hemorrhage control and treatment steps include establishing large-bore IV access, administering IV fluids or blood products as needed, and reversing coagulopathy.

Reference

- Bucher, J. (2016). Bleeding hand wounds. EmDocs. http://www.emdocs.net/bleeding-hand-wounds/


Medical Students' Perspectives on Trauma-Informed Care Training.
Trauma training can fill a knowledge gap and provide associated benefits for medical students.
Goldstein E, Murray-García J, Sciolla AF, Topitzes J. Medical Students' Perspectives on Trauma-Informed Care Training. Perm J. 2018;22:17-126. doi: 10.7812/TPP/17-126. PMID: 29401053; PMCID: PMC5798942.

Question 71

A 23-year-old unidentified man presents to the Emergency Department with altered mental status and lethargy. Bystanders found the man lying face down in the street alongside his vomit. Local Emergency Medical Services were called by bystanders to bring the man to the hospital. The patient's medical history is not known. On examination, his temperature is 36°C, blood pressure 100/70 mmHg, pulse 56 beats/min, respiratory rate 5 breaths/min, and oxygen saturation is 86% on room air. Glucose is 100 mg/dL (5.5 mmol/L). He is lethargic with no obvious signs of trauma. He responds minimally to painful stimuli in the extremities. Pupils are 1mm bilaterally, and the skin is dry and cool.

Which of the following is the most appropriate next step in management for this patient's condition?

A. IV Lorazepam 2 mg
B. IV Naloxone 0.4 mg
C. IV Atropine 1 mg
D. IV Dextrose 25 g

Question 72

A 28-year-old man presents to the Emergency Department with severe agitation. The man was found yelling and running in the street outside of a large house party. The patient is unable to provide details about his medical history due to his severe agitation. On examination, his temperature is 38°C, blood pressure 170/95 mmHg, pulse 125 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The patient appears restless and aggressive at times. He has no obvious signs of external trauma. Pupils are 7mm bilaterally, and the skin is diaphoretic.

Which of the following is the most likely cause of this patient's condition?

A. Anticholinergic toxidrome
B. Cholinergic toxidrome
C. Sympathomimetic toxidrome
D. Opioid toxidrome

Question 73

A 34-year-old woman presents to the Emergency Department after ingestion of an unknown agent as part of a suicide attempt. The patient's husband says she has been suffering from worsening depression and told him that she "wanted to end it all" earlier during the day. When he arrived home, he found the woman in bed lethargic, next to multiple open pill bottles. The patient's medical history includes depression, anxiety, diabetes, polysubstance abuse (alcohol, heroin, cocaine), and seizures. Home medications include alprazolam, escitalopram, metformin, and levetiracetam. On examination, her temperature is 37°C, blood pressure 98/50 mmHg, pulse 62 beats/min, respiratory rate 10 breaths/min, and oxygen saturation is 95% on room air.
Glucose is 100 mg/dL (5.5 mmol/L). The patient is somnolent but is able to follow basic commands. She has no obvious signs of external trauma. Pupils are 4mm bilaterally, and the skin is dry.

Which of the following is the most likely cause of this patient's condition?

A Heroin

B Alprazolam

C Cocaine

D Paracetamol (APAP)

Question 74

A 43-year-old male farm worker presents to the Emergency Department with difficulty breathing, altered mental status, hypersalivation, and vomiting. The patient's wife says he has been increasingly depressed since his mother died two weeks ago. She is worried the patient may have ingested something in an attempt to kill himself. The patient has no known medical history and does not take any medications regularly. On examination, his temperature is 37°C, blood pressure 92/54 mmHg, pulse 51 beats/min, respiratory rate 45 breaths/min, and oxygen saturation is 89% on room air. Glucose is 100 mg/dL (5.5 mmol/L). The patient is agitated and uncomfortable with diaphoretic skin. He is drooling and tachypneic without obvious mouth or tongue swelling.
The pupils are 1mm bilaterally, and the eyes have many tears.

Which of the following is the most appropriate next step in management for this patient's condition?

A Endotracheal intubation

B IV Atropine

C Patient decontamination

D IM Pralidoxime

Question 75

A 30-year-old woman presents to the Emergency Department with altered mental status after ingestion of an unknown agent as part of a suicide attempt. The patient was found disoriented at home next to multiple open pill bottles and an empty bottle of alcohol. The patient's medical history includes attention deficit hyperactivity disorder (ADHD) and environmental allergies. Home medications include dextroamphetamine for ADHD and diphenhydramine as needed for allergies. On examination, her temperature is 38.5°C, blood pressure 160/80 mmHg, pulse 135 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. Glucose is 90 mg/dL (5.0 mmol/L). The patient is agitated, disoriented, and has no obvious signs of external trauma. Her pupils are 7mm bilaterally, and the skin is hot and dry.

Question: Which of the following is the most likely cause of this patient's condition?

A. Paracetamol (APAP)

B. Dextroamphetamine

C. Ethanol

D. Diphenhydramine

Question 76

A 32-year-old woman presents to the Emergency Department after ingesting pain medications as part of a suicide attempt. The patient admits to taking 11grams of paracetamol (APAP) about 10 hours ago. She began to feel nausea and mild upper abdominal discomfort over the last several hours. She denies vomiting, fevers, or other ingestions. On examination, her temperature is 37°C, blood pressure 130/70 mmHg, pulse 94 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. Glucose is 90 mg/dL (5.0 mmol/L). The patient has a soft abdomen with mild tenderness in the epigastrium and right upper quadrant. A serum APAP level is drawn and analyzed in the hospital laboratory.

Which of the following is the most appropriate next step in management?

A. PO Activated Charcoal

B. IV N-Acetylcysteine (NAC)

C. Prepare for liver transplantation

D. IV Sodium bicarbonate

Question 77

A 57-year-old woman presents to the Emergency Department for altered mental status and tachypnea. Her son says she has also been complaining of nausea and tinnitus for one day. She has a medical history of hypertension, obesity, and bilateral knee osteoarthritis. Her medications include amlodipine and topical oil of wintergreen for her osteoarthritis pain. On examination, her temperature is 37.8°C, blood pressure 155/90 mmHg, pulse 135 beats/min, respiratory rate 35 breaths/min, and oxygen saturation is 98% on room air. Glucose is 90 mg/dL (5.0 mmol/L). The patient has a patent airway. She is tachypneic with clear lungs. Skin is warm and diaphoretic. She is awake but mildly confused. Pupils are 3mm bilaterally. An intravenous line is placed and a liter bolus of normal saline is started. Next, an arterial blood gas is performed with the results shown below.

Test	Test Result	Reference Range
pH	7.55	(7.35-7.45)
pCO2	20	(35-45)
pO2	84	(80-100)
HCO3	18	(22-26)

Which of the following is the most appropriate next step in management?

A PO Activated Charcoal

B IM Glucagon 1 mg

C IV Atropine 2 mg

D IV NaHCO3 infusion

Question 78

A 25-year-old man presents to the Emergency Department with slurred speech and somnolence. The patient was said to have been drinking homemade alcohol he had brought to a party earlier in the evening. The patient is unable to provide details about his medical history due to his depressed mental status. On examination, his temperature is 37°C, blood pressure 110/65 mmHg, pulse 75 beats/min, respiratory rate 12 breaths/min, and oxygen saturation is 95% on room air. Glucose is 90 mg/dL (5.0 mmol/L). The patient is somnolent and does not respond to painful stimuli. Pupils are 4mm bilaterally. He has clear lungs bilaterally but has no gag reflex. His Glasgow Coma Score is 3. Endotracheal intubation is performed due to the patient's aspiration risk and lethargy.

Which of the following is the most likely cause for this patient's condition?

A Paracetamol (APAP) overdose

B Methanol ingestion

C Fomepizole overdose

D Opioid overdose

Question 79

A 34-year-old woman presents to the Emergency Department with altered mental status and hypotension after ingestion multiple pills at home. The patient was found disoriented at home next to an empty bottle of amitriptyline tablets. The patient's medical history includes major depressive disorder and fibromyalgia. On examination, her temperature is 37.5°C, blood pressure 85/40 mmHg, pulse 130 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 99% on room air. Glucose is 90 mg/dL (5.0 mmol/L). The patient is combative, disoriented, and has no obvious signs of external trauma. Her pupils are 8mm bilaterally, and the skin is hot and dry. Intravenous access is established, and IV normal saline is started.

Which of the following is the most appropriate next step in management?

A IV physostigmine

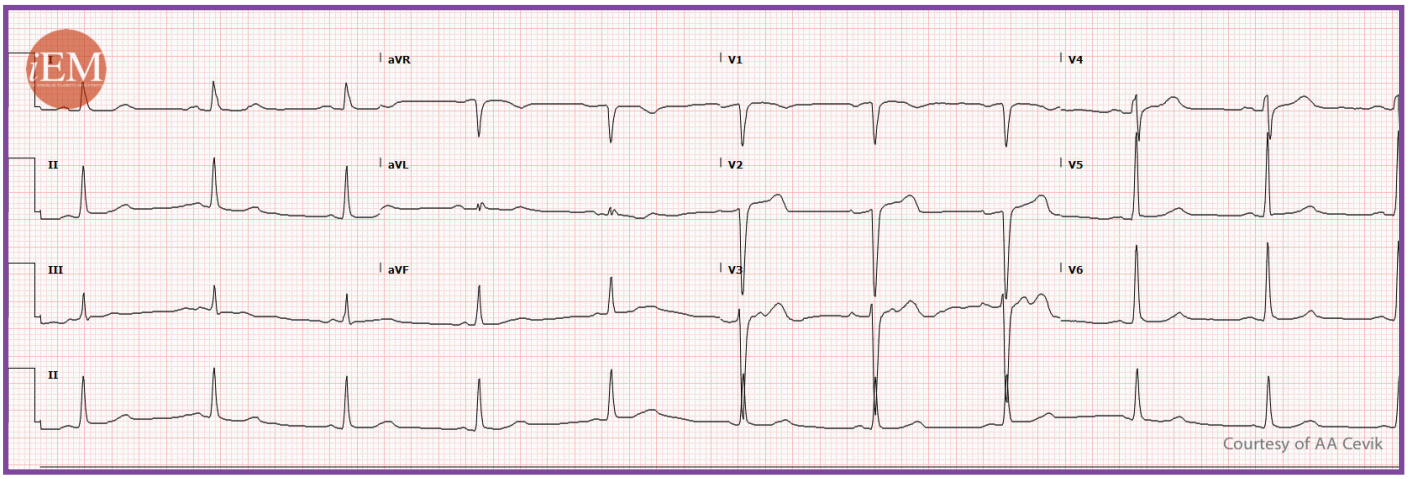
B IV norepinephrine

C IV sodium bicarbonate

D IV metoprolol

Question 80

A 68-year-old man presents to the Emergency Department with fatigue and dizziness after accidentally ingesting too many hypertension medications at home. The patient says he accidentally took two extra doses of his heart medications today. He had taken a nap earlier in the day and forgot that he took his first dose of the medication, so he took two extra doses to make up for the dose he thought he had missed. After counting his pills, he realized he took extra doses of his diltiazem. He took the extra diltiazem doses 1.5 hours ago. He is currently experiencing generalized fatigue and dizziness when standing. He denies any chest pain, syncopal episodes, fevers, or blood in the stool. His medical history includes hypertension, paroxysmal atrial fibrillation, and diabetes. His daily medications include warfarin, diltiazem, metformin, and hydrochlorothiazide. On examination, his temperature is 37°C, blood pressure 80/40 mmHg, pulse 54 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. Glucose is 220 mg/dL (12.2 mmol/L). The patient is alert and oriented with clear lungs bilaterally. A 12-lead EKG is performed and shown below.



Which of the following is the most appropriate next step in management for this patient's condition?

A IV Glucagon

B IV Fluids

C Immediate transvenous pacing

D IV Calcium gluconate

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Explanation – Question 71

This patient arrives to the Emergency Department with lethargy, decreased respiratory rate, hypoxemia, pinpoint pupils, and a normal glucose level. The initial evaluation and treatment of this patient should be focused on the management of the patient's airway, breathing, and circulation (ABCs, also known as the 'primary survey'). First, the airway should be repositioned to minimize obstructions to breathing, such as the tongue. Vomitus in the airway can also be removed manually or via suction to prevent airway obstruction or aspiration. Next, supplemental oxygen should be provided to treat the patient's hypoxemia. Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke, post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. This patient's history and exam support the presence of an opioid toxidrome. See the chart below for a review of the most common toxidromes (toxic syndromes).

Toxidrome Type	Antidote / Treatment*	Heart Rate + Blood Pressure	Temp	Pupils	Bowel Sounds	Skin (wet/ dry)
Anticholinergic	Benzodiazepines + Physostigmine	↑	↑	Dilated	↓	Dry
Cholinergic	Atropine	No change/ ↓	No change	Pinpoint	↑	Wet
Opioid	Naloxone	↓	↓	Pinpoint	↓	Dry
Sympathomimetic	Benzodiazepines	↑	↑	Dilated	↑	Wet
Sedative-Hypnotic	Flumazenil**	↓	↓	Normal	↓	Dry

**Treatment of all toxic ingestions should include general supportive care and management of the patient's airway, breathing, and circulation. Examples include administering supplemental oxygen in hypoxia, IV fluids in hypotension, and cooling measures in hyperthermia.*

***Flumazenil is the antidote for benzodiazepine overdose, but it is rarely used clinically as it can trigger benzodiazepine-refractory seizures.*

In addition to supportive treatments, like airway repositioning and supplemental oxygen, the antidote to opioid overdose should be promptly administered. Naloxone **(Choice B)** is the antidote to opioid overdose. Naloxone can be administered intravenously, intramuscularly, and intranasally. Naloxone should be started at a dose of 0.04 mg and can be administered every 2-3 minutes at incrementally higher doses to a maximum total dose of 10 mg. The goal of Naloxone administration is to achieve independent ventilation. Administering a larger initial dose of 0.4 mg or 1 mg can precipitate acute opioid withdrawal in a chronic opioid user. IV Lorazepam (Choice A) is a benzodiazepine and would make the patient more sedated. Benzodiazepines are helpful in patients with an active seizure, severe agitation, or anxiety. Anticholinergic overdose (atropine, scopolamine) or sympathomimetic overdose (cocaine, methamphetamines, MDMA) are also responsive to benzodiazepines. IV Atropine (Choice C) is an anticholinergic agent. Atropine would worsen this patient's borderline hypotension and mild bradycardia. IV Dextrose (Choice D) would be a reasonable medication if the glucose was unknown. However, the question stem provides a normal glucose level.

References

- Kitchen, L. (2015). The Approach to the Poisoned Patient. EMDocs. http://www.emdocs.net/the-approach-to-the-poisoned-patient/
- Santos, C. (2017). Tox Cards: Narcan (naloxone). EMDocs. http://www.emdocs.net/tox-cards-narcan-naloxone/

Explanation – Question 72

This patient presents to the Emergency Department with severe agitation and altered mental status. His exam demonstrates hypertension, tachycardia, elevated temperature, restlessness, dilated pupils, and wet diaphoretic skin. Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke, post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. This patient's history and exam support the presence of a toxidrome. See the chart below for a review of the most common toxidromes (toxic syndromes).

Toxidrome Type	Antidote / Treatment*	Heart Rate + Blood Pressure	Temp	Pupils	Bowel Sounds	Skin (wet/ dry)
Anticholinergic	Benzodiazepines + Physostigmine	↑	↑	Dilated	↓	Dry
Cholinergic	Atropine	No change/ ↓	No change	Pinpoint	↑	Wet
Opioid	Naloxone	↓	↓	Pinpoint	↓	Dry
Sympathomimetic	Benzodiazepines	↑	↑	Dilated	↑	Wet
Sedative-Hypnotic	Flumazenil**	↓	↓	Normal	↓	Dry

**Treatment of all toxic ingestions should include general supportive care and management of the patient's airway, breathing, and circulation. Examples include administering supplemental oxygen in hypoxia, IV fluids in hypotension, and cooling measures in hyperthermia.*

***Flumazenil is the antidote for benzodiazepine overdose, but it is rarely used clinically as it can trigger benzodiazepine-refractory seizures.*

This patient has a sympathomimetic toxidrome **(Choice C)**, which can be caused by cocaine, MDMA (ecstasy), methamphetamine, and other drugs. The anticholinergic toxidrome (Choice A) has many overlapping features with the sympathomimetic toxidrome, such as elevated blood pressure and heart rate, elevated temperature, agitation, and dilated pupils. One feature that can be used to differentiate these toxidromes is the skin exam. Sympathomimetic agents commonly cause wet diaphoretic skin, while anticholinergic agents cause dry skin. The cholinergic toxidrome (Choice B) presents with increased secretions (wet skin, diarrhea, vomiting, hypersalivation, bronchorrhea, etc.). One cause of this toxidrome is exposure to organophosphates. This patient is diaphoretic, but otherwise does not possess the other features of cholinergic toxidrome. The opioid toxidrome (Choice D) would present with somnolence, as opposed to the CNS excitation seen in this patient.

Reference

- Christy, G. (2019). EM@3AM: Overdose. EMDocs. http://www.emdocs.net/em3am-overdose/

Explanation – Question 73

This patient presents to the Emergency Department with a depressed mental status and normal-sized pupils after an unknown toxic ingestion. Many agents can act as Central Nervous System depressants and cause this clinical presentation. Some examples include ethanol, toxic alcohols (methanol, ethylene glycol, isopropyl alcohol), benzodiazepines, barbiturates, opioids, and muscle relaxants.

Heroin (Choice A) and Alprazolam **(Choice B)** are the most likely of the choices listed. Heroin is an opioid, and Alprazolam is a benzodiazepine (a sedative-hypnotic agent). The clinical presentation

caused by overdoses of opioids versus sedative-hypnotic agents overlaps in many areas, but the pupillary exam can help the most in differentiating the type of ingestion. Opioids can constrict pupils and cause pinpoint pupils, while benzodiazepines should not cause a change in pupillary size. See the chart on page 129 for a review of the most common toxidromes (toxic syndromes). Cocaine (Choice C) is a sympathomimetic with a CNS excitatory effect, not a CNS depressant effect, as in this patient. A large ingestion of paracetamol (Choice D) is often accompanied with little to no symptoms in the first 24 hours. However, liver failure and its associated sequelae can occur later in the ingestion timeline if no antidote is given.

Reference

- Kitchen, L. (2015). The Approach to the Poisoned Patient. EMDocs. http://www.emdocs.net/the-approach-to-the-poisoned-patient/

Explanation – Question 74

This patient presents to the Emergency Department with altered mental status, difficulty breathing, vomiting, and hypersalivation after an unknown ingestion. His exam shows an ill patient with constricted pupils (miosis), wet skin (diaphoresis), bradycardia, and tachypnea. Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke, post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. This patient's constellation of signs and symptoms supports the presence of a cholinergic toxidrome due to organophosphate poisoning. See the chart on page 129 for a review of the most common toxidromes (toxic syndromes).

Cholinergic toxidromes can be caused by organophosphate or carbamate pesticides, as well as nerve gas agents (i.e., sarin gas). These agents cause poisoning by increasing the amount of acetylcholine at the neuromuscular junction, causing stimulation at muscarinic and nicotinic acetylcholine receptors. This causes a dramatic increase in bodily secretions with increased respiratory secretions and airway compromise as the most common cause of death in this population. The cholinergic toxidrome can be remembered with the mnemonic "DUMBBELLS" (diarrhea/diaphoresis, urination, miosis, bradycardia, bronchorrhea, emesis, lacrimation, low BP, salivation).

Patient decontamination is the first step in treating any patient who could be the potential cause to harm or expose staff members to the poisoning agent (Choice C). This patient should be undressed and adequately decontaminated by staff members who wear personal protective equipment (PPE). Once the patient is decontaminated, the airway should be established with endotracheal tube placement (Choice A), and IV atropine (Choice B) should be given to reverse the toxidrome. Atropine can be started at 2-4mg IV and repeated every 5-10 minutes until respiratory secretions are cleared. Pralidoxime (Choice D) should also be given as soon as possible to prevent irreversible changes ("aging") to the acetylcholinesterase at the neuromuscular junction. Depending on the agent, this timeframe varies from minutes to hours after exposure. All choices provided in this question are important actions to take, but patient decontamination **(Choice C)** is the most important initial next step.

References

- Kitchen, L. (2015). The Approach to the Poisoned Patient. EMDocs. http://www.emdocs.net/the-approach-to-the-poisoned-patient/
- Sahi, N. (2018). TOXCard: Nerve agents. EM Docs.
- http://www.emdocs.net/toxcard-nerve-agents/

Explanation – Question 75

This patient presents to the Emergency Department with altered mental status after ingestion of an unknown agent as part of a suicide attempt. Her exam demonstrates hypertension, tachycardia, elevated temperature, disorientation, dilated pupils, and dry and hot skin. Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke, post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. This patient's history and exam support the presence of a toxidrome. See the chart below for a review of the most common toxidromes (toxic syndromes).

Toxidrome Type	Antidote / Treatment*	Heart Rate + Blood Pressure	Temp	Pupils	Bowel Sounds	Skin (wet/ dry)
Anticholinergic	Benzodiazepines + Physostigmine	↑	↑	Dilated	↓	Dry
Cholinergic	Atropine	No change/ ↓	No change	Pinpoint	↑	Wet
Opioid	Naloxone	↓	↓	Pinpoint	↓	Dry
Sympathomimetic	Benzodiazepines	↑	↑	Dilated	↑	Wet
Sedative-Hypnotic	Flumazenil**	↓	↓	Normal	↓	Dry

**Treatment of all toxic ingestions should include general supportive care and management of the patient's airway, breathing, and circulation. Examples include administering supplemental oxygen in hypoxia, IV fluids in hypotension, and cooling measures in hyperthermia.*

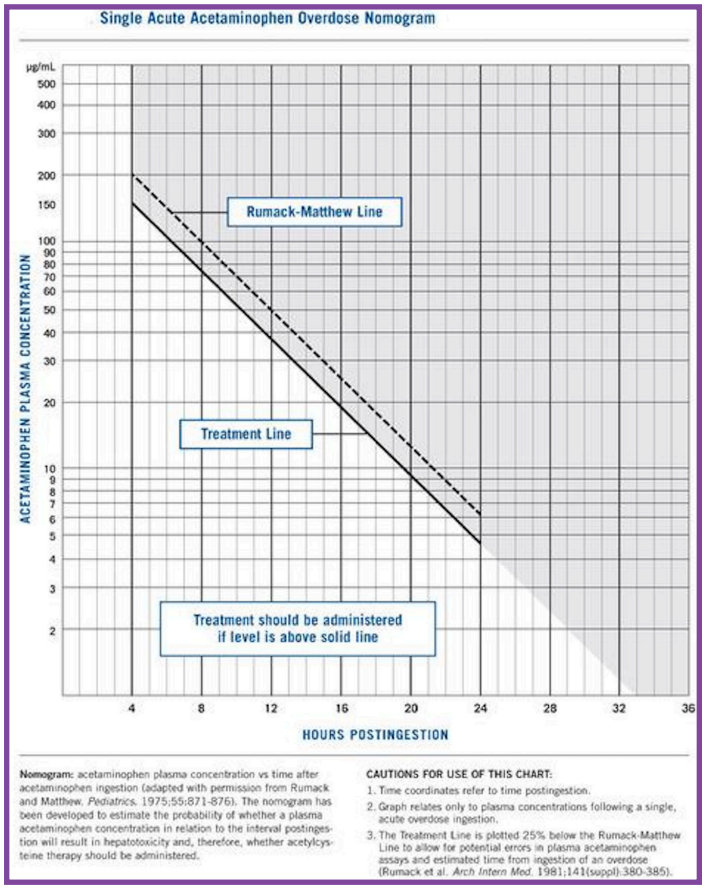
***Flumazenil is the antidote for benzodiazepine overdose, but it is rarely used clinically as it can trigger benzodiazepine-refractory seizures.*

Paracetamol (Choice A) is often accompanied with little to no symptoms in the first 24 hours. However, liver failure and its associated sequelae can occur later in the ingestion timeline if no antidote is given. The symptoms exhibited by the patient do not correlate with APAP overdose. Dextroamphetamine (Choice B) is a sympathomimetic agent that could be responsible for many of the patient's symptoms, like elevated heart rate, hypertension, agitation, and dilated pupils. However, dextroamphetamine should cause diaphoretic skin, not the dry skin that the patient has. Ethanol (Choice C) may be a co-ingested agent in this scenario that could lead to agitation and confusion, but ethanol alone should not cause fever. Diphenhydramine (Choice D) is an antihistamine agent but also has anticholinergic properties, especially when taken in excess. This patient has all the signs of an anticholinergic toxidrome. The presence or absence of dry skin can help differentiate a sympathomimetic toxidrome from an anticholinergic toxidrome. Diphenhydramine **(Choice D)** is the most likely agent responsible for this patient's symptoms.

References

- Kitchen, L. (2015). The Approach to the Poisoned Patient. EMDocs. http://www.emdocs.net/the-approach-to-the-poisoned-patient/
- Srisuma, S. (2015). Physostigmine for management of anticholinergic toxidrome. EM Docs. http://www.emdocs.net/physostigmine-for-management-of-anticholinergic-toxidrome/

This patient arrives to the Emergency Department 10 hours after ingesting 11grams of paracetamol (APAP). She has mild nausea and upper abdominal discomfort symptoms and normal vital signs. Paracetamol, also known as acetaminophen or APAP, is a commonly used pain medication safe for use in childhood, pregnancy, and breastfeeding. Paracetamol is an ingredient in many over-the-counter pain, headache, and cold medications. Toxic paracetamol doses are acute ingestions over 150 mg/kg, or about 10 grams in adults. Toxic paracetamol doses for children are 150 mg/kg. Multiple ingestions of paracetamol over 24 or 48 hours can also cause toxicity. Ingestions of 10grams over 24 hours or 6 grams/day over 48hours can also cause toxicity in adults. Symptoms of acute poisoning can be absent or mild in the first 24 hours, as seen in this patient. After 24 hours, AST, ALT, bilirubin, and INR levels begin to increase, and over 72 hours post-ingestion, hepatic failure ensues. Five days after acute ingestion, multi-organ failure occurs, or hepatotoxicity resolves (less common). The toxicity of APAP is thought to be caused by a toxic metabolite produced during APAP breakdown in the liver known. This toxin is known as NAPQI. APAP overdose can be fatal without treatment with the antidote commonly known as NAC or N-acetylcysteine. NAC is a free radical scavenger and prevents the damage caused by NAPQI. Therefore, if serum APAP testing is available, APAP levels drawn 4 hours after acute ingestion are used to determine if NAC is warranted. APAP levels over 150 mcg/mL at 4 hours are the threshold for starting NAC. This is based on the use of the Rumack-Mathew Nomogram for APAP (see below image used from https://commons.wikimedia.org/wiki/File:Rumack_Matthew_nomogram_with_treatment_(study)_line.pdf, by Merlin Crystal). Since this patient's acute ingestion is above the known 10-gram toxic dose, it is reasonable to start N-acetylcysteine therapy (Choice B) without knowing the exact serum APAP level. PO Activated charcoal (Choice A) can be used after oral ingestions to help bind some toxic substances and prevent their absorption through the GI system. However, the majority of APAP is absorbed 2-4 hours after ingestion, so charcoal would not be helpful in this case, where the ingestion was 10 hours ago. Liver transplantation (Choice C) may ultimately be required for this patient, depending on the liver function tests and how the patient responds over the coming days. However, the best next step is NAC treatment to prevent liver failure and death. IV Sodium bicarbonate (Choice D) is used in salicylate and tricyclic antidepressant overdose, but it has no role in APAP overdose. Therefore, the best next step is IV N-Acetylcysteine **(Choice B)**.



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- Hendrickson RG. Acetaminophen. In: Goldfrank's Toxicologic Emergencies 9th edition. Nelson LS, et al (Eds). New York, NY, McGraw-Hill 2011.

Explanation – Question 77

This patient presents to the Emergency Department for altered mental status, nausea, and tinnitus (ear ringing). Her exam shows a confused female with tachypnea, tachycardia, borderline fever, wet skin, and normal pupil size. Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke, post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. The immediate evaluation and treatment of this patient should focus on the 'ABCs' or an abnormality in the airway, breathing, and circulation. Any rapidly correctable causes of altered mental status, like hypoxia, hypoglycemia, and hyperthermia, should be addressed appropriately at this stage (i.e., supplemental oxygen, IV dextrose, and body cooling).This patient's exam mimics many aspects of a sympathomimetic toxidrome; however, being aware that wintergreen oil is a potent salicylate will lead to the diagnosis. This patient has salicylate poisoning. Salicylates are present in many over-the-counter pain medications, including aspirin, oil of wintergreen (methyl salicylate), and Pepto-Bismol (bismuth subsalicylate). An acute overdose of salicylates may present as tachycardia, hypertension, and hyperthermia, similar to a sympathomimetic toxidrome. Other features include tinnitus, altered mental status, seizures, and coma. The patient's ABG shows a respiratory alkalosis (elevated pH, low pCO2) mixed with a metabolic acidosis (low HCO3). Salicylic acid disrupts the body's ability to process energy at the cellular level by acting as an 'uncoupler' of the oxidative phosphorylation process. Salicylates directly stimulate the respiratory centers in the brainstem, triggering hyperventilation and increased lactic and pyruvic acid. Hyperventilation causes the initial respiratory alkalosis, and the elevated lactic and pyruvic acid later causes an increased anion gap metabolic acidosis or a mixed metabolic acidosis and respiratory alkalosis.

The treatment of salicylate overdose is prompt IV NaHCO3 infusion (Choice D) to alkalinize the urine and blood. This assists in the more rapid clearance of salicylates. Hemodialysis can be considered if salicylate levels are over 80-100 mg/dL or if there is a persistent altered mental status, acidosis, or organ failure despite starting the NaHCO3 infusion. PO Activated charcoal (Choice A) helps bind certain toxins and prevent their absorption through the GI tract. Charcoal is most beneficial when it is used early after drug ingestion. This patient was exposed to salicylates by a topical route, so PO charcoal would not be helpful. IM Glucagon (Choice B) is useful in hypoglycemia and beta-blocker overdose. This patient is not hypoglycemic and was not exposed to beta-blockers. IV Atropine (Choice C) is helpful in patients with a cholinergic toxidrome (i.e., organophosphates, nerve gases) but would not be beneficial in this patient. Atropine would likely worsen the patient's tachycardia. The best next step would be IV NaHCO3 infusion **(Choice D)**.

Reference

- Berger, M. (2018). Salicylate Toxicity. CORE-EM. https://coreem.net/core/salicylate-toxicity-salicylism/

Explanation – Question 78

This patient presents to the Emergency Department from a party with slurred speech and somnolence after drinking homemade alcohol. On exam, his vital signs and glucose are normal, he is nonresponsive to pain, and he has a GCS of 3 (normal GCS is 15). He is intubated due to his inability to protect his airway and risk of aspiration. Intubation is an important first step in managing this patient.

Altered mental status has a broad differential diagnosis, including intracranial bleeding, stroke,

post-ictal state, hypoglycemia, electrolyte abnormalities, other metabolic causes, infectious etiologies, toxicological causes, and many other conditions. The immediate evaluation and treatment of this patient should focus on the 'ABCs' or any abnormality in the airway, breathing, and circulation. Any rapidly correctable causes of altered mental status, like hypoxia, hypoglycemia, or hyperthermia, should be addressed appropriately at this stage (i.e., supplemental oxygen, intubation, IV dextrose, and body cooling).

Paracetamol (APAP) overdose (Choice A) often accompanies minor to no symptoms in the first 24 hours. Later in the ingestion timeline, liver failure and its associated sequelae can occur if no antidote is given. The symptoms exhibited by the patient do not correlate with APAP overdose. Opioid overdose (Choice D) can cause severely depressed mental status, as seen in this patient. However, opioid overdose also has decreased respiratory rate, pinpoint pupils, and sometimes associated bradycardia or hypotension. This patient has normal vital signs and normal pupil size. This patient ingested some type of alcohol at the party, but it is unclear if it is ethanol or a toxic alcohol (i.e., methanol, ethylene glycol). Both ethanol and methanol ingestion (Choice B) can cause similar exam findings of depressed mental status as in this patient. Other features of toxic alcohol ingestion include vision changes (methanol), hemorrhagic gastritis (isopropyl alcohol), coma, seizures, and hyperventilation (respiratory compensation for severe acidosis). Ethanol and many toxic alcohols will cause an increased anion gap metabolic acidosis with an increased osmolar gap. Helpful tests to differentiate ethanol from a toxic alcohol are serum levels of ethanol and serum toxic alcohol levels (if available). A somnolent, intoxicated-appearing patient with a negative ethanol level should raise suspicion for toxic alcohol poisoning. Urine studies may also show oxalate crystals in ethylene glycol ingestion. Since ethanol is not a listed choice and laboratory studies are not provided, methanol ingestion **(Choice B)** is the most likely cause of this patient's symptoms. Fomepizole (Choice C) is an intravenous medication that inhibits the alcohol dehydrogenase enzyme. Fomepizole is the antidote to toxic alcohols by slowing the production of dangerous toxic alcohol metabolites. Therefore, the correct answer is Choice B.

References:

- Bedford I. (2015). The unhappy drunk: Toxic alcohols. EmDocs. Retrieved from http://www.emdocs.net/the-unhappy-drunk-toxic-alcohols/
- Burns, E. (2020). Toxic Alcohol Ingestion. Life in the Fast Lane. Retrieved from https://litfl.com/toxic-alcohol-ingestion/

Explanation – Question 79

This patient arrives to the Emergency department with altered mental status and hypotension after ingestion of multiple pills at home. On exam, she is hypotensive, tachycardic, confused, and has dilated pupils with dry skin. The patient has most likely ingested amitriptyline tablets, given the history provided in the question. Amitriptyline is a tricyclic antidepressant medication. Despite the clear history, it is crucial to check levels for possible other coingestants, like paracetamol (APAP) and salicylates. Tricyclic antidepressants (TCAs) impact many different receptors in the body, so the clinical presentation of a patient with TCA overdose can vary considerably.

Important features to remember are cardiovascular toxicity with a widened QRS and hypotension, as well as an anticholinergic toxidrome. A 12-lead EKG should be ordered early in any case of possible overdose, and an EKG in TCA overdose is a crucial step in evaluation. Supportive care and IV sodium bicarbonate are the mainstays of treatment for TCA overdose. See the table below for details regarding these patients' clinical features and treatment.

Toxic effects of Tricyclic Antidepressant (TCA) overdose	Clinical Features	Treatment
Na-channel blockade	Cardiac arrythmias, Wide QRS (>100msec), Prominent R wave in AvR (>3mm)	IV Sodium Bicarbonate 100mEq (1-2mEq/kg), Titrate to QRS <100 and/or improved hypotension
Alpha-1 adrenergic receptor blockade	Hypotension	IVF, vasopressors
Serotonin reuptake blockade	Seizures	Benzodiazepines
Muscarinic- Ach receptor blockade (Anticholinergic)	Anticholinergic toxidrome- altered mental status, delirium, hyperthermia, tachycardia, hypertension, dilated pupils, dry skin	Benzodiazepines, supportive care. Avoid Physostigmine.
Histamine receptor (H1) blockade	Drowsiness, coma	Supportive care

IV Physostigmine (Choice A) can be used to treat an anticholinergic toxidrome along with supportive care and benzodiazepines. This patient does appear to have an anticholinergic toxidrome, but there is a high suspicion for TCA overdose. Physostigmine should be avoided in TCA overdose due to data indicating worse outcomes in TCA overdose patients who receive physostigmine. IV Norepinephrine (Choice B) may eventually be required to manage this patient's hypotension. However, IV fluids and sodium bicarbonate to reverse the cardiac toxicity should be used first. IV Metoprolol (Choice D) may help relieve the tachycardia, but it would worsen the patient's hypotension and shock state. The best next step is IV Sodium bicarbonate **(Choice C)**, the treatment for TCA overdose. Sodium bicarbonate prevents TCA from binding to cardiac sodium channels, thereby stabilizing the heart and preventing cardiac dysrhythmias and death. Sodium bicarbonate is given as an infusion until the QRS interval shortens <100msec and the hypotension improves.

References

- Paris, J. (2017). Tricyclic Antidepressant Toxicity. CORE-EM. https://coreem.net/core/tricyclic-antidepressant-toxicity/
- Pickens, A. (2015). TCA Toxicity. EM in 5 [VIDEO]. https://emin5.com/2015/12/22/tca-toxicity/

Explanation – Question 80

This patient presents to the Emergency Department with generalized weakness and dizziness after accidentally ingesting extra diltiazem tablets 1.5 hours prior to arrival. The exam shows bradycardia, hypotension, an elevated glucose level, and a patient without altered mental status. The EKG shows sinus bradycardia without any conduction blocks.

This patient's clinical presentation is likely due to diltiazem overdose. Diltiazem is a calcium channel blocker. Calcium channel blocker medications are categorized as dihydropyridines (nifedipine, amlodipine, nicardipine) and non-dihydropyridines (verapamil, diltiazem). Dihydropyridines (DHPs) cause systemic vasodilation, hypotension, and often reflex tachycardia in overdose. The non-DHPs act more directly on the heart with fewer peripheral effects and cause hypotension and bradycardia. Calcium channel blocker overdose can mimic beta blocker overdose as both medication classes have similar effects on the body. The initial management of any patient who has ingested a potentially dangerous medication is the "ABCs", also known as the primary survey. This includes assessment and management of the airway (i.e., intubation for somnolence and aspiration risk), breathing (i.e.,

supplemental oxygen for hypoxia), and circulation (i.e., IV fluids, vasopressors for hypotension). Decontamination is another consideration depending on the agent the patient has been exposed to. An EKG should be ordered early in all toxic ingestions to evaluate signs of cardiac toxicity, such as a prolonged QT interval or prolonged QRS interval. Checking for other dangerous coingestants, like serum levels of salicylates and paracetamol (APAP), should be routinely done. Specific toxic effects seen in calcium channel blocker and beta blocker overdose are outlined in the chart below.

Toxic effects of Calcium Channel Blocker (CCB) overdose	Toxic effects of Beta Blocker (BB) overdose	Treatment
Bradycardia Hypotension Hyperglycemia Altered mental status AV conduction blocks + dysrhythmias	Bradycardia Hypotension Hypoglycemia Altered mental status AV conduction blocks + dysrhythmias	• General supportive care ('ABCs') • Activated charcoal if early after ingestion (< 2hours) For hypotension + bradycardia: • IV Fluids • Vasopressors (i.e., IV norepinephrine) • IV Atropine • Consider transcutaneous or transvenous pacing Adjunctive treatments: • IV Glucagon • IV Calcium • High dose insulin therapy + glucose (0.5-1 U/kg/hour) • Intralipid therapy

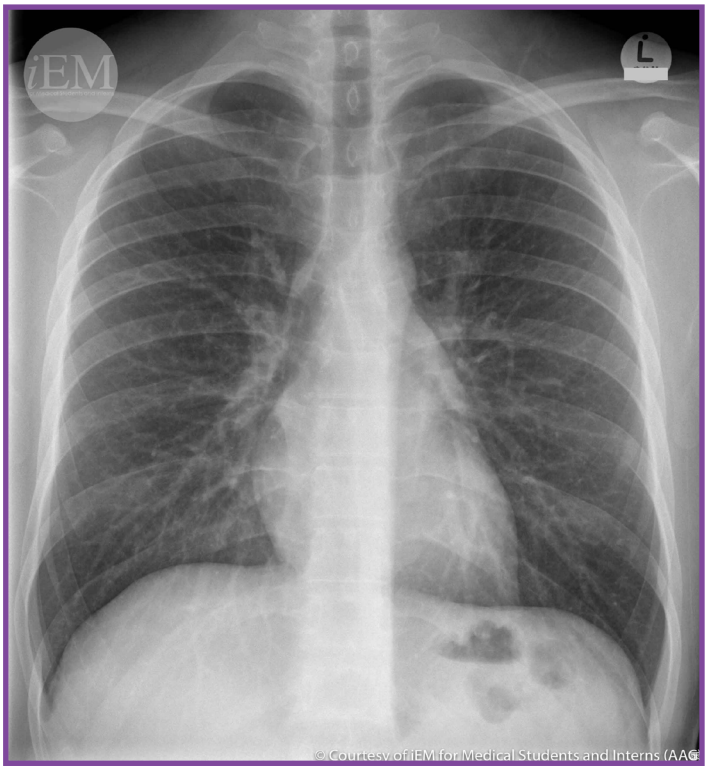
IV Glucagon (Choice A) is useful as an adjunctive treatment in both calcium channel blocker and beta-blocker overdoses. However, glucagon often causes vomiting and is not a first-line agent. Before glucagon, IV fluids, atropine, vasopressors, and activated charcoal should be attempted. Antiemetics should be considered prior to IV Glucagon administration, given its side effect of nausea and vomiting. Transvenous pacing (Choice C) and IV Calcium gluconate (Choice D) are second-line treatments when the patient is not responding to IV fluids, atropine, or vasopressors. The best next step, in this case, is to administer IV Fluids **(Choice B).**

References

- Pickens, A. (2013). Calcium channel blocker (CCB) toxicity. EM in 5 [VIDEO]. https://emin5.com/2013/09/09/calcium-chanel-blocker-ccb-toxicity/
- Simon, E. (2017). EM@3AM- Calcium channel blocker toxicity. EM Docs. http://www.emdocs.net/em3am-calcium-channel-blocker-toxicity/

Question 81

A 48-year-old woman presents to the Emergency Department complaining of shortness of breath for one day. She says the difficulty breathing started acutely while watching television and is accompanied by pleuritic chest discomfort. She denies fever, cough, vomiting, changes in urination, or recent surgeries. Her medical history includes pancreatic cancer, hypertension, and diabetes. On examination, her temperature is 37°C, blood pressure 110/70mmHg, pulse 125 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 97% on room air. Fingerstick glucose is 135 mg/dL (7.5 mmol/L). The lungs are clear to auscultation bilaterally. The patient's chest X-ray is below.



Which of the following is the most likely diagnosis for this patient's condition?

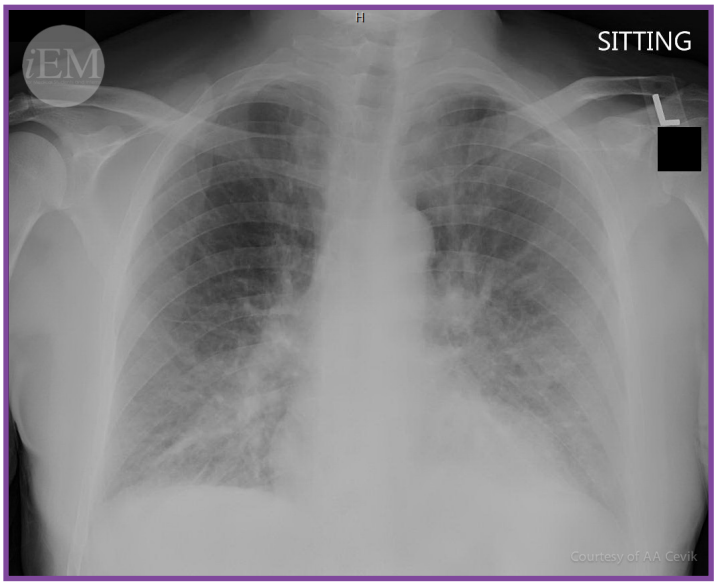
A Pneumothorax

B Diabetic Ketoacidosis

C Pulmonary Embolism

D Pneumonia

Question 82



A 68-year-old man presents to the Emergency Department complaining of shortness of breath for one day. He says the difficulty breathing started when he woke up this morning. He denies chest pain, fever, or cough. His medical history includes hypertension, hyperlipidemia, coronary artery disease, congestive heart failure, and diabetes. He says he has not taken most of his home medications for his medical conditions for the last week. On examination, his temperature is 37°C, blood pressure 190/95 mmHg, pulse 110 beats/min, respiratory rate 25 breaths/min, and oxygen saturation is 91% on room air. Fingerstick glucose is 165 mg/dL (9.1 mmol/L). The lungs have crackles bilaterally on auscultation. The lower extremities have 2+ edema. The patient's chest X-ray is given.

Which of the following is the most likely cause of this patient's condition?

A Diabetic ketoacidosis

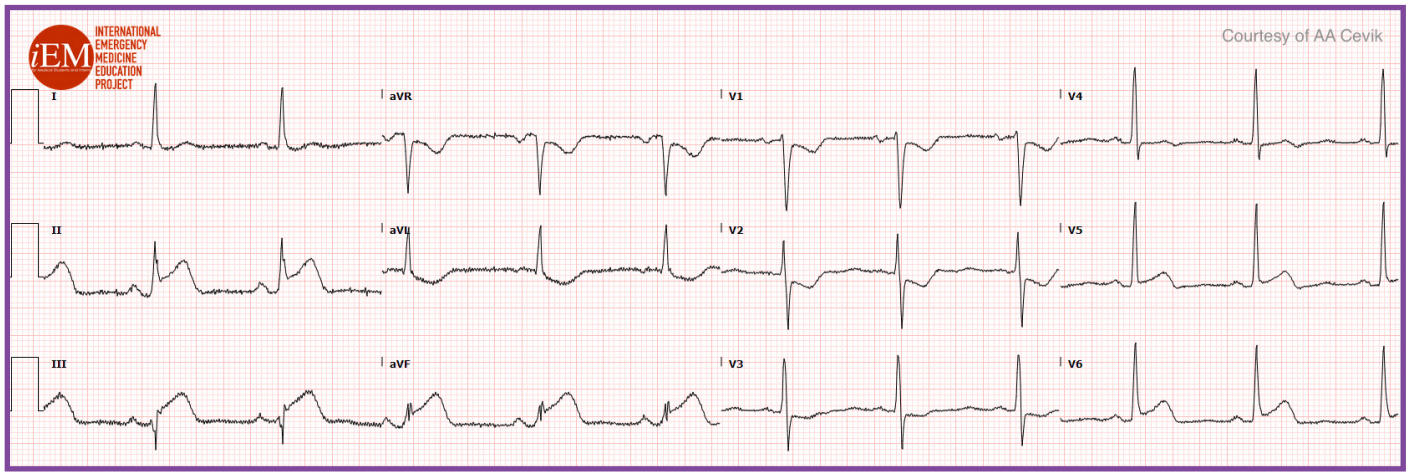
B Congestive heart failure

C Myocardial infarction

D Pneumonia

Question 83

A 74-year-old man presents to the Emergency Department complaining of worsening shortness of breath, nausea, and generalized weakness for 6 hours. He denies cough, vomiting, fevers, numbness, headache, or difficulty with speech. His medical history includes hypertension, hyperlipidemia, and diabetes. On physical examination, his temperature is 37°C, blood pressure 115/85 mmHg, pulse 70 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. The patient appears uncomfortable but is not in any acute distress. Lungs are clear to auscultation bilaterally. The patient's 12-lead EKG is below.



Which of the following is the most appropriate next step in management for this patient's condition?

A Provide supplemental oxygen

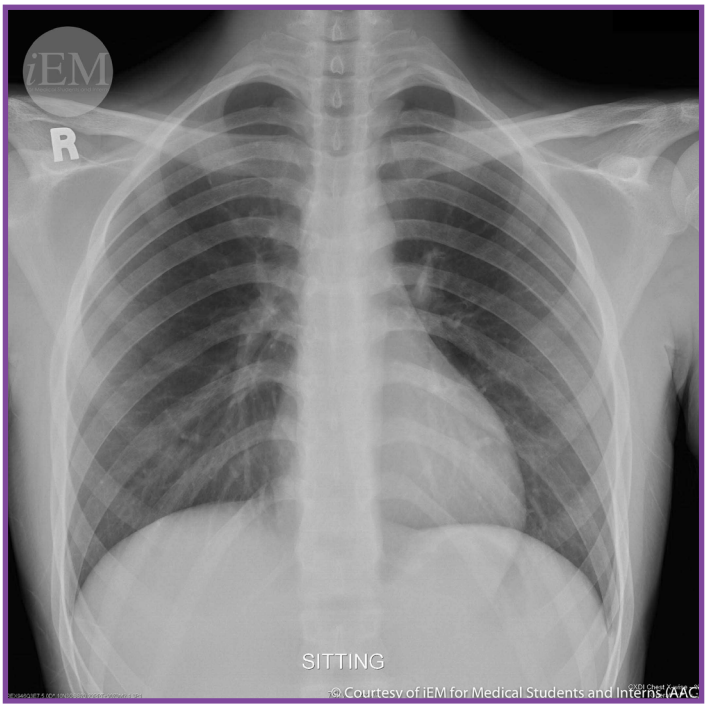
B Administer aspirin

C Administer sublingual nitroglycerin

D Order CT head to evaluate weakness

Question 84

A 23-year-old man presents to the Emergency Department complaining of worsening shortness of breath and generalized weakness for three days. He denies chest pain, cough, or fevers. His medical history includes Type 1 diabetes and asthma. On physical examination, his temperature is 37°C, blood pressure 105/70 mmHg, pulse 125 beats/min, respiratory rate 30 breaths/min, oxygen saturation is 98% on room air, and bedside glucose testing is 500 mg/dL (27.7 mmol/L). The patient appears tachypneic and mildly confused. The patient's Chest X-ray is below.

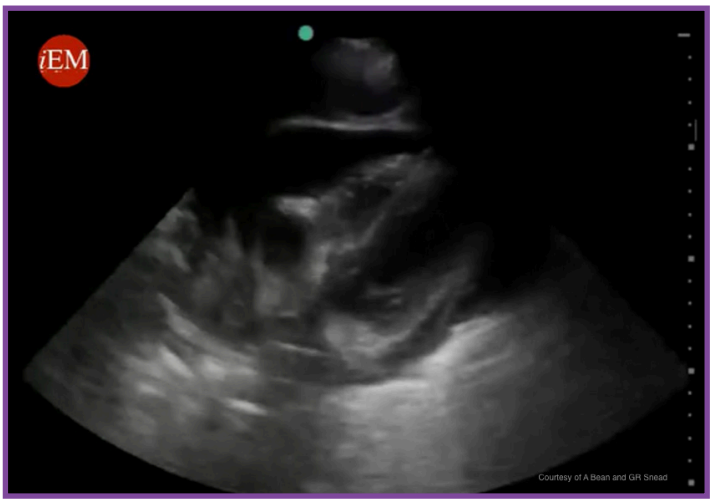


Which of the following is the most appropriate next step in management for this patient's condition?

A. IV insulin infusion
B. IV lactated ringers solution
C. Nebulized Beta-2 agonist
D. Endotracheal intubation

Question 85

A 63-year-old man presents to the Emergency Department complaining of shortness of breath for two days. He denies cough, fevers, chest pain, or syncope. His medical history includes metastatic colon cancer, hypertension, chronic obstructive pulmonary disease, and diabetes. On examination, his temperature is 37°C, blood pressure 85/40 mmHg, pulse 130 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 98% on room air. The lungs are clear to auscultation bilaterally with symmetric breath sounds. Heart sounds are distant and the extremities are cool to touch. A bedside point-of-care ultrasound is conducted with an image below of the exam.

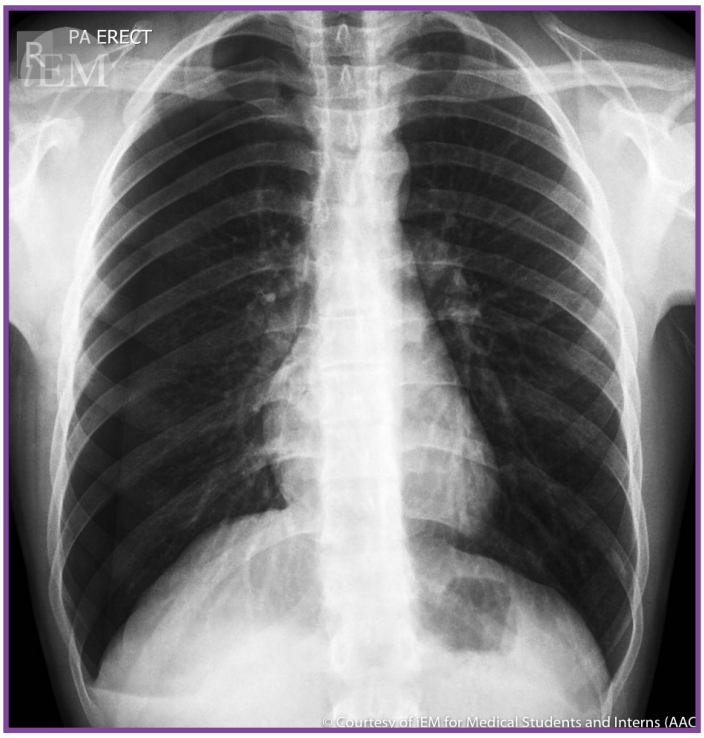


Which of the following is the most likely cause for this patient's condition?

A. Pulmonary embolism
B. Tension pneumothorax
C. Pneumonia with septic shock
D. Cardiac tamponade

Question 86

A 52-year-old man presents to the Emergency Department complaining of acute onset shortness of breath that began 3 hours ago. He has associated right-sided pleuritic chest pain and a dry cough. He denies fevers or syncope. His medical history includes years of tobacco smoking, hypertension, and chronic obstructive lung disease. On examination, his temperature is 37°C, blood pressure 155/95 mmHg, pulse 95 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 95% on room air. The patient's upright chest X-ray is below.



Which of the following is the most appropriate next step in management for this patient's condition?

A. IV Heparin bolus and infusion

B. Supplemental oxygen

C. Needle decompression to right chest

D. IV Azithromycin

Question 87

A 32-year-old female presents to the Emergency Department complaining of shortness of breath and decreased exercise tolerance for five days. She denies chest pain, fevers, or blood in the stool. Her last menstrual period was one week ago. Her medical history includes asthma, menorrhagia, and carpal tunnel syndrome. She takes no daily medications and denies recent surgeries, travel, or cancer history. On examination, her temperature is 37°C, blood pressure 115/80 mmHg, pulse 105 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air. The patient appears pale but in no acute distress. Lungs are clear to auscultation bilaterally. There is no pretibial pitting edema. Select blood testing is performed, and the results are shown in the table below.

Test	Test Result	Reference Range
BUN	14	6 – 24 mg/dL
Creatinine	0.87	0.59 – 1.04 mg/dL
Hemoglobin	5.5	12.0 – 15.0 g/dL
WBC count	5.2	4.5 to 11.0 × 109/L
HCG quantitative	0	<5 mIU/mL

Which of the following is the most like cause of this patient's condition?

A. Asthma

B. Ruptured ectopic pregnancy

C. Heavy menses

D. Pulmonary embolism

Question 88

A 26-year-old female presents to the Emergency department complaining of shortness of breath and generalized abdominal discomfort for one day. She denies vaginal bleeding, fevers, or dysuria. Her last menstrual period was six weeks ago, but she states that her menses are sometimes irregular. She has no medical history and does not take any daily medications. On examination, her temperature is 37°C, blood pressure 80/45 mmHg, pulse 130 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 98% on room air. Lungs are clear to auscultation bilaterally and the abdomen is soft, tender in all quadrants, and mildly distended. A urine pregnancy test is positive. Intravenous fluids are started by nursing staff.

Which of the following is the most appropriate next step in management?

A. Methotrexate for ruptured ectopic

B. IV Antibiotics

C. Transvaginal ultrasound

D. Consult OBGYN for operative management

Question 89

A 26-year-old man presents to the Emergency department complaining of shortness of breath and body rash over the last 1 hour. The symptoms started while eating a seafood dinner at a restaurant. His medical history includes asthma, and he takes an albuterol inhaler as needed. On examination, his temperature is 37°C, blood pressure 90/50 mmHg, pulse 122 beats/min, respiratory rate 25 breaths/min, and oxygen saturation is 95% on room air. The patient has mild swelling of both lips and the tongue. Diffuse moderate wheezing is auscultated on both lungs. There is an urticarial rash on the chest and upper extremities.

Which of the following is the most appropriate next step in management?

A. IV Epinephrine 1 mg

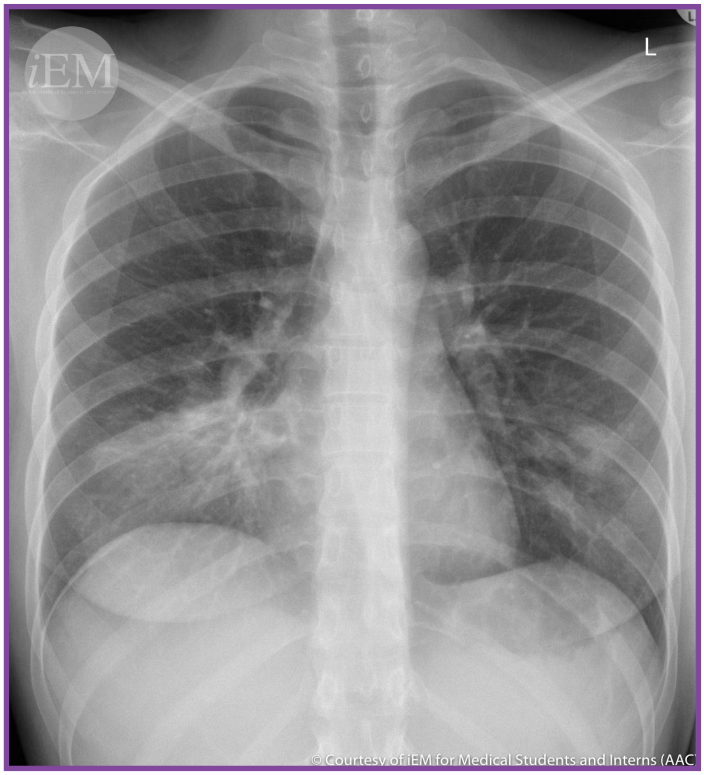
B. IM Epinephrine 0.3 mg

C. IV Dexamethasone 10 mg

D. IV Diphenhydramine 50 mg

Question 90

A 55-year-old female presents to the Emergency Department complaining of shortness of breath, fever, and productive cough for five days. She denies recent travel, recent hospitalizations or surgeries, weight loss, or sick contacts. Her medical history includes tobacco smoking, hypertension, hyperlipidemia, and diabetes. On examination, her temperature is 39°C, blood pressure 145/95 mmHg, pulse 118 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 93% on room air. On auscultation of the lungs, the left lung is clear and the right lung has rhonchi at the base. Intravenous fluids and antipyretics are started by nursing staff.



Which of the following is the most likely cause of this patient's condition?

A. Septic pulmonary emboli

B. Right infected pleural effusion

C. Right middle lobe pneumonia

D. Right-sided pulmonary embolism

Explanation – Question 81

Shortness of breath, also known as dyspnea, is a common reason for patients to visit the Emergency Department. Dyspnea is often caused by a pulmonary or cardiovascular condition, but it is important to remember that dyspnea can be due to endocrine conditions, toxicologic conditions, neurologic conditions, hematologic conditions, musculoskeletal conditions, and psychiatric conditions.

The initial approach to all patients with shortness of breath involves the primary survey, or "ABCs" (Airway, Breathing, Circulation). This first involves checking the patient for a patent airway. A simple method to assess the airway is to ask the patient to speak and listen for the voice. A muffled voice, stridor, hematemesis, or a lethargic patient indicates that a patent airway may not be present. Problems with the airway, such as an obstructing foreign body, inflammation (i.e., epiglottitis, anaphylactic shock), or vocal cord dysfunction, can certainly cause shortness of breath. Endotracheal intubation may need to be performed before moving forward. Next, breathing is assessed by evaluating the function of the lungs. Steps include looking at how the patient is breathing (fast or slow), measuring a SpO2 level, and auscultating both lungs for wheezing, crackles, rhonchi, or distant or absent sounds. A low oxygen level should be immediately addressed with supplemental oxygen before moving forward. The patient's breathing rate and lung sounds can be very helpful in discovering the diagnosis and guiding treatment. Lastly, circulation should be assessed. Check the heart rate, blood pressure, peripheral pulses, skin color and temperature, and evaluate for any sites of bleeding. Hypotension or tachycardia should be addressed appropriately based on the presumed cause. After the primary assessment ("ABCs") and initial treatment actions, a more detailed history and physical exam should be conducted. The chart below outlines the pertinent causes of shortness of breath for the emergency practitioner to know.

	Selected Causes of Shortness of Breath (Dyspnea)
Pulmonary	Tension pneumothorax, pneumonia, empyema, pleural effusion, pulmonary edema, asthma, COPD
Cardiovascular	Acute coronary syndrome (i.e., STEMI), pulmonary embolism, cardiac tamponade, Decompensated Congestive Heart Failure (acute pulmonary edema)
Endocrine	Diabetic ketoacidosis (Kussmaul breathing)
Toxicologic	Salicylate overdose, or any ingestion that causes a severe metabolic acidosis
Neurologic	Intracranial hemorrhage, Stroke, Spinal cord injury, Guillain-Barre syndrome, Myasthenia Gravis crisis (myasthenic crisis)
Hematologic	Severe anemia (i.e., GI bleeding, trauma, miscarriage, post-partum hemorrhage, ruptured ectopic pregnancy)
Musculoskeletal	Rib fracture, flail chest
Psychiatric	Anxiety, Panic attack
Airway Problem	Foreign body, epiglottitis, anaphylactic shock (laryngeal swelling), expanding neck hematoma

This patient presents to the Emergency Department with one day of acute onset shortness of breath with pleuritic chest pain. Her exam shows tachycardia, tachypnea, a normal glucose level, and clear lungs bilaterally. The chest X-ray provided shows no acute abnormalities. Pneumothorax (Choice A) can present as acute onset shortness of breath with pleuritic chest pain, but the chest X-ray shows no signs of pneumothorax. Diabetic Ketoacidosis (Choice B) can cause shortness of breath, and this

patient has a history of diabetes. However, the patient lacks other symptoms of this condition, such as hyperglycemia (often glucose >250 mg/dL (13.8 mmol/L)), polydipsia, polyphagia, polyuria, or vomiting. This makes DKA an unlikely diagnosis. Pneumonia (Choice D) is also unlikely as there is no fever, no cough, and no infiltrate seen on the chest X-ray provided. Therefore, pulmonary embolism **(Choice C)** is the most likely diagnosis and the correct answer.

The most common presenting symptom in pulmonary embolism (PE) is shortness of breath. Other symptoms seen in PE include chest pain worsened by deep inspiration, unilateral leg swelling, hemoptysis, and fever. Risk factors for PE include immobility, recent surgery or hospitalization, trauma, or hypercoagulable states (malignancy, estrogen use, Factor V Leiden mutation, and antiphospholipid syndrome). Common signs of PE on physical examination include tachycardia (common), fever (less common), and sometimes hypotension in a massive PE causing obstructive shock. The gold standard for PE diagnosis is CT pulmonary angiography, but D-dimer blood testing, bedside ultrasound, and other tests can be useful in PE diagnosis. The mainstay of treatment in PE is anticoagulation. Unfractionated heparin and low molecular weight heparin are equally effective in PE. Surgical treatment (embolectomy) and thrombolysis (alteplase) are other treatment options for larger PEs.

References

- Alexander, D. (2016). Approach to tachypnea in the ED setting. EM Docs. http://www.emdocs.net/approach-tachypnea-ed-setting/
- Nickson, C. (2020). Pulmonary Embolism. Life in the Fastlane.
- https://litfl.com/pulmonary-embolism/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 82

The chart on page 143 outlines the pertinent causes of shortness of breath for the emergency practitioner to know. This patient presents to the Emergency Department with one day of shortness of breath without chest pain, fevers, or a cough. He has been noncompliant with his home medications for his multiple comorbid conditions. The exam shows tachypnea, tachycardia, hypertension, a low oxygen level, pulmonary crackles, and peripheral edema. The chest X-ray shows bilateral pulmonary congestion and infiltrates consistent with pulmonary edema.

Diabetic ketoacidosis (Choice A) can cause shortness of breath, but severe hypertension, fluid overload on physical examination, and lack of hyperglycemia make DKA less likely. Pneumonia (Choice D) can cause shortness of breath but often has other symptoms like cough, fever, and sometimes chest pain. It is difficult to rule out underlying pneumonia in the presence of pulmonary edema by solely looking at the chest X-ray. The patient's peripheral edema, severe hypertension, and lack of cough and fever make pneumonia a less likely diagnosis responsible for that patient's symptoms. Myocardial infarction (Choice C) often presents with chest pain but can present with only shortness of breath. A severe myocardial infarction with cardiogenic shock can result in acute fluid overload, as seen in this patient, but hypotension would be expected. A 12-lead EKG is required to evaluate for myocardial infarction more fully, but the constellation of symptoms this patient has makes congestive heart failure **(Choice B)** the most likely diagnosis. Immediate initial actions for this patient should include placing the patient on a cardiac monitor, obtaining a 12-lead EKG, sitting the patient upright to assist with breathing, and providing supplemental oxygen. Acute decompensated heart failure should be aggressively treated with Nitroglycerin to lower the blood pressure and stress on the heart (preload). Noninvasive positive pressure ventilation (NIPPV), such as BiPAP or CPAP, is another crucial initial

step to help provide oxygenation, lower the preload, and push the fluid out of the lungs. IV diuresis to remove fluid from the body and evaluating for the underlying cause are other important steps in acute CHF management.

References

- Alexander, D. (2016). Approach to tachypnea in the ED setting. EM Docs. http://www.emdocs.net/approach-tachypnea-ed-setting/
- Grino, A. (2015). Congestive Heart Failure. CORE-EM.
- https://coreem.net/core/congestive-heart-failure/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 83

The chart below outlines the pertinent causes of shortness of breath for the emergency practitioner to know.

	Selected Causes of Shortness of Breath (Dyspnea)
Pulmonary	Tension pneumothorax, pneumonia, empyema, pleural effusion, pulmonary edema, asthma, COPD
Cardiovascular	Acute coronary syndrome (i.e., STEMI), pulmonary embolism, cardiac tamponade, Decompensated Congestive Heart Failure (acute pulmonary edema)
Endocrine	Diabetic ketoacidosis (Kussmaul breathing)
Toxicologic	Salicylate overdose, or any ingestion that causes a severe metabolic acidosis
Neurologic	Intracranial hemorrhage, Stroke, Spinal cord injury, Guillain-Barre syndrome, Myasthenia Gravis crisis (myasthenic crisis)
Hematologic	Severe anemia (i.e., GI bleeding, trauma, miscarriage, post-partum hemorrhage, ruptured ectopic pregnancy)
Musculoskeletal	Rib fracture, flail chest
Psychiatric	Anxiety, Panic attack
Airway Problem	Foreign body, epiglottitis, anaphylactic shock (laryngeal swelling), expanding neck hematoma

This patient arrives to the Emergency Department with several hours of shortness of breath, nausea, and generalized weakness. On physical exam, the vital signs are normal. There is no tachypnea, hypoxemia, or respiratory distress, and the lungs are clear. Clear lungs in a patient with respiratory distress should raise concern for acute coronary syndrome, pulmonary embolism, cardiac tamponade, anemia, and metabolic acidosis.

The 12-lead EKG provided shows an inferior ST-elevation Myocardial Infarction (STEMI). This is demonstrated through the ST segment elevations in the inferior EKG leads (II, III, AvF) and the reciprocal changes in the lateral leads (most notably in AvL). The presence or absence of chest pain is not provided in this question, but patients with acute coronary syndromes do not always have chest pain. Elderly patients and women are more likely to present with non-chest pain anginal equivalents, like shortness of breath, lethargy, or nausea. The acute coronary syndrome is diagnosed through a 12-lead EKG, blood troponin levels, and history and physical exam.

A STEMI is the most severe of all acute coronary syndromes and requires prompt recognition and treatment with antiplatelets (i.e., aspirin plus clopidogrel or ticagrelor), heparin, pain management

(morphine or nitroglycerin), and percutaneous coronary intervention (PCI). Providing supplemental oxygen (Choice A) is unnecessary as the patient has no hypoxemia and a normal lung exam. Administration of sublingual nitroglycerin (Choice C) can help alleviate ischemic chest pain and other symptoms associated with a STEMI but is contraindicated in inferior STEMIs. Using nitroglycerin in inferior STEMIs can result in dangerous hypotension due to cardiac preload reduction. This patient has a STEMI, and a CT head to evaluate weakness (Choice D) will not be helpful. In general, a detailed neurological exam assessing for motor deficits will be more valuable than a CT head to determine the etiology of a patient's weakness. The best next step, in this case, is to administer 324 mg aspirin **(Choice B)** to this patient with a STEMI.

References

- Alexander, D. (2016). Approach to tachypnea in the ED setting. EM Docs. http://www.emdocs.net/approach-tachypnea-ed-setting/
- Nickson, C. (2021). Acute Coronary Syndromes. Life in the Fastlane. https://litfl.com/acute-coronary-syndromes/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 84

The chart on page 145 outlines the pertinent causes of shortness of breath for the emergency practitioner to know. This patient arrives to the Emergency Department with shortness of breath and generalized weakness for three days. On physical exam, there is tachycardia, tachypnea, normal oxygen saturation, and markedly elevated glucose. The Chest X-ray provided is normal; there are no lung infiltrates or pleural effusions. This patient has diabetic ketoacidosis (DKA). DKA is a serious condition of insulin deficiency characterized by hyperglycemia, metabolic acidosis, and ketosis. Presenting symptoms include weakness, increased thirst (polydipsia), increased hunger (polyphagia), increased urination (polyuria), abdominal pain, or vomiting. Shortness of breath can also be seen in DKA as metabolic ketoacidosis triggers an increased respiratory rate to drive more exhaled carbon dioxide out of the body. This deep rapid breathing seen in severe DKA is known as Kussmaul breathing. The treatment of DKA involves IV fluids for hydration, insulin infusion, and close monitoring for electrolyte derangements (potassium abnormalities are common). In addition, DKA patients are severely dehydrated due to osmotic diuresis from their hyperglycemic state. For this reason, IV fluid resuscitation is the first step in DKA management. Either normal saline or lactated ringers (Choice B) can be used, although large volumes of normal saline can worsen the acidotic state by causing hyperchloremic metabolic acidosis.

Intravenous fluids should be started with a 20-30cc/kg bolus. IV insulin infusion (Choice A) should never be started without a potassium level, and no potassium level is provided in the question stem. This is because insulin lowers potassium, and administration of insulin without a potassium level can result in hypokalemia, arrhythmia, and death.

Endotracheal intubation (Choice D) should be avoided in DKA whenever possible, as the patient's respiratory status serves as a compensation for the metabolic acidosis. This patient is tachypneic and mildly confused, but he is not somnolent and does not require immediate intubation. Intubated DKA patients need carefully monitored ventilator settings in combination with blood gas measurements to avoid worsening acidosis and cardiac arrest. Nebulized beta-2 agonist (i.e., albuterol, salbutamol) is helpful in asthma; however, this patient has DKA and not an asthma exacerbation. IV lactated ringers solution **(Choice B)** is the best next step.

References

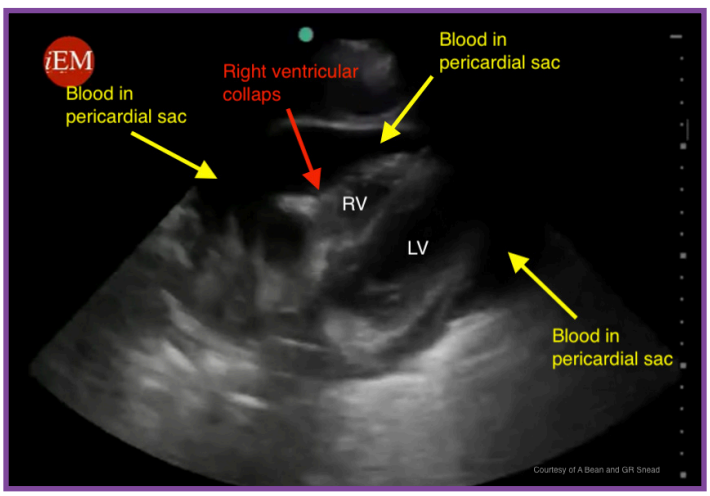
- Alexander, D. (2016). Approach to tachypnea in the ED setting. EM Docs. http://www.emdocs.net/approach-tachypnea-ed-setting/
- Swaminathan, A. (2016). Diabetic Ketoacidosis (DKA). CORE-EM. https://coreem.net/core/dka/

Explanation – Question 85

The chart below outlines the pertinent causes of shortness of breath for the emergency practitioner to know.

	Selected Causes of Shortness of Breath (Dyspnea)
Pulmonary	Tension pneumothorax, pneumonia, empyema, pleural effusion, pulmonary edema, asthma, COPD
Cardiovascular	Acute coronary syndrome (i.e., STEMI), pulmonary embolism, cardiac tamponade, Decompensated Congestive Heart Failure (acute pulmonary edema)
Endocrine	Diabetic ketoacidosis (Kussmaul breathing)
Toxicologic	Salicylate overdose, or any ingestion that causes a severe metabolic acidosis
Neurologic	Intracranial hemorrhage, Stroke, Spinal cord injury, Guillain-Barre syndrome, Myasthenia Gravis crisis (myasthenic crisis)
Hematologic	Severe anemia (i.e., GI bleeding, trauma, miscarriage, post-partum hemorrhage, ruptured ectopic pregnancy)
Musculoskeletal	Rib fracture, flail chest
Psychiatric	Anxiety, Panic attack
Airway Problem	Foreign body, epiglottitis, anaphylactic shock (laryngeal swelling), expanding neck hematoma

This patient presented to the Emergency Department with two days of shortness of breath without chest pain, cough, or fevers. The exam shows tachycardia, hypotension, mild tachypnea, clear lungs, and distant heart sounds. Tension pneumothorax (Choice B) can cause hypotension and tachycardia and COPD is a risk factor for pulmonary bleb formation and rupture. However, the lungs are equal and clear bilaterally, so this diagnosis is not likely. Septic shock due to pneumonia (Choice C) is also less likely as there is no fever, the lungs are clear, and the patient lacks a cough. The ultrasound image given also provides a clear explanation for the patient's symptoms. This patient is at risk for pulmonary embolism (Choice A) given his cancer history, which can cause a hypercoagulable state and predispose him to clot formation.



Again, an understanding of the ultrasound image will provide the diagnosis.The ultrasound image is a subxiphoid view of the heart demonstrating a pericardial effusion with compression of the right ventricle (red arrow).

This presentation is consistent with cardiac tamponade **(Choice D)**. Cardiac tamponade is a condition defined by the accumulation of fluid in the pericardial sac to the point of right ventricular collapse and obstructive shock. Common presenting symptoms of cardiac tamponade include shortness of breath, chest pain, or nonspecific

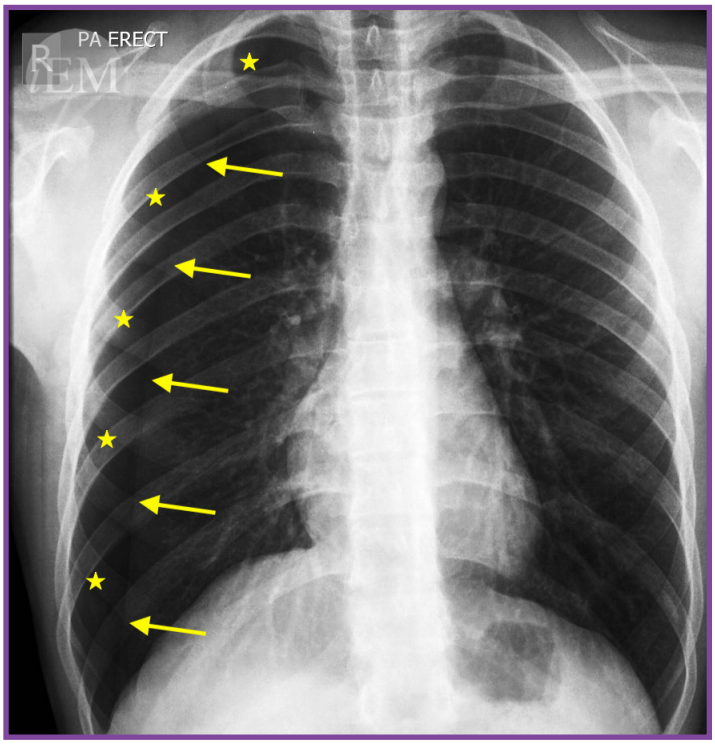
symptoms. Risk factors for this diagnosis are penetrating chest trauma (hemopericardium), cancer (malignant effusion), lupus, end-stage renal disease, uremia, HIV, Tuberculosis, or a history of chest radiation. Hemodynamic instability (hypotension and tachycardia) is a hallmark of this condition, although the early stages of tamponade can be seen on cardiac ultrasound before vital signs decompensate. The patient may have Beck's triad of muffled distant heart sounds, jugular venous distension, and hypotension, although the majority of patients with cardiac tamponade do not have all three of these signs together. Treatment involves IV fluids, bedside pericardiocentesis (ultrasound guided preferred), and surgical pericardiotomy ("pericardial window").

References

- Kurkowski, K. (2015). Ultrasound guided pericardiocentesis. CORE-EM. https://coreem.net/core/ultrasound-guided-pericardiocentesis/
- Slama, R. (2015). The crashing patient with cardiac tamponade: ED management. EMDocs. http://www.emdocs.net/the-crashing-patient-with-cardiac-tamponade-ed-management/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 86

The chart on page 147 outlines the pertinent causes of shortness of breath for the emergency practitioner to know. This patient arrives to the Emergency Department with acute onset shortness of breath with pleuritic right-sided chest pain. On exam, there is mild tachypnea and a borderline low SpO2 of 95% on room air. The chest X-ray demonstrates a small right-sided pneumothorax (see the location of yellow stars below).



Needle decompression to the right chest (Choice C) would be the right choice if the patient had a right-sided tension pneumothorax. Signs of tension pneumothorax are hypotension, tachycardia, tracheal deviation, and mediastinal shift on Chest X-ray. Tension pneumothorax should be diagnosed clinically without a chest X-ray and promptly treated with needle decompression with a 14-16 gauge needle at the 4th-5th intercostal space in the anterior-mid-axillary line. Needle decompression is always followed by the placement of a formal chest tube. This patient does not have the hemodynamic instability or chest X-ray findings of a classic tension pneumothorax. IV Azithromycin (Choice D) would be appropriate for a COPD exacerbation or community-acquired pneumonia. This patient has a cough but lacks fever and sputum production, and he also has a pneumothorax on X-ray that can explain his symptoms. An IV Heparin bolus and infusion (Choice A) would be the ideal treatment for a pulmonary embolism or acute coronary syndrome. Again, the Chest X-ray supports an alternative cause for the patient's symptoms. The best next step is supplemental oxygen **(Choice B)**. 100% supplemental oxygen helps decrease the time to lung expansion in patients with pneumothoraces. A nonrebreather mask at 15 L/min is ideal for providing this oxygen level.

This patient has a small pneumothorax (<3 cm between lung margin and chest wall). Small primary pneumothoraces have two treatment options. The first option is to administer 100% oxygen and place a pigtail catheter for rapid lung re-expansion. The second option is to only administer 100% oxygen administration for 4-6 hours, followed by a repeat chest X-ray to evaluate for improvement of the pneumothorax. If the pneumothorax is improving and symptoms are improving (less shortness of breath and chest pain), the patient can be discharged home with close outpatient follow-up and no chest tube placement. Deciding which treatment option is best should depend on the patient's ability to follow up with a doctor, patient reliability, and resource availability. This patient does have a small pneumothorax by measurement, but he likely has a secondary pneumothorax from his COPD. Secondary pneumothoraces have a higher recurrence rate and almost always require chest tube placement. Regardless, the best initial step in treatment is supplemental oxygen **(Choice B)**.

References

- Bartels, B. (2020). EM@3AM: Pneumothorax. CORE-EM. http://www.emdocs.net/em3am-pneumothorax/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 87

The chart below outlines the pertinent causes of shortness of breath for the emergency practitioner to know.

	Selected Causes of Shortness of Breath (Dyspnea)
Pulmonary	Tension pneumothorax, pneumonia, empyema, pleural effusion, pulmonary edema, asthma, COPD
Cardiovascular	Acute coronary syndrome (i.e., STEMI), pulmonary embolism, cardiac tamponade, Decompensated Congestive Heart Failure (acute pulmonary edema)
Endocrine	Diabetic ketoacidosis (Kussmaul breathing)
Toxicologic	Salicylate overdose, or any ingestion that causes a severe metabolic acidosis
Neurologic	Intracranial hemorrhage, Stroke, Spinal cord injury, Guillain-Barre syndrome, Myasthenia Gravis crisis (myasthenic crisis)
Hematologic	Severe anemia (i.e., GI bleeding, trauma, miscarriage, post-partum hemorrhage, ruptured ectopic pregnancy)
Musculoskeletal	Rib fracture, flail chest
Psychiatric	Anxiety, Panic attack
Airway Problem	Foreign body, epiglottitis, anaphylactic shock (laryngeal swelling), expanding neck hematoma

This patient arrives at the Emergency department with shortness of breath and decreased exercise tolerance for five days. Her vital signs are normal and her lungs are clear, but she appears pale. The laboratory test shows normal kidney function, a negative serum pregnancy test, and a markedly low hemoglobin level. A ruptured ectopic pregnancy (Choice B) can cause shortness of breath due to anemia and hemorrhagic shock, but this patient has a negative pregnancy test. Asthma (Choice A) is unlikely, given the patient's normal lung exam without wheezing and no mention of cough. A pulmonary embolism (Choice D) is possible due to tachycardia, but the patient lacks other risk factors, as stated in the question stem. A D-Dimer test could help further evaluate if this patient has a pulmonary embolism, but the low hemoglobin likely explains the patient's symptoms. The patient's history of menorrhagia, also known as heavy menses **(Choice C)**, is a common cause of anemia in women of

childbearing age. Even though this patient is not currently menstruating, her heavy menses are the most likely cause of her shortness of breath. Therefore, choice C is the best answer.

References

- Simon, E. (2017). EM@3AM- Anemia. EMDocs. http://www.emdocs.net/em3am-anemia/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/Simon, E. (2017). EM@3AM- Anemia. EMDocs. http://www.emdocs.net/em3am-anemia/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 88

The chart on page 149 outlines the pertinent causes of shortness of breath for the emergency practitioner to know. This patient arrives to the Emergency Department with shortness of breath and abdominal discomfort for one day. On exam, she is hypotensive, tachycardic, and tachypneic. Her lungs are clear, the abdomen is tender and distended, and the pregnancy test is positive. This patient has a ruptured ectopic pregnancy until proven otherwise and requires prompt surgical management. Once diagnosed by the Emergency clinician, ectopic pregnancy can be managed medically or surgically. See the chart below for more details.

Treatment options for ectopic pregnancy

Medical Management (Methotrexate) Indicated	Surgical Management Indicated
Patient hemodynamically stable	Patient hemodynamically unstable
HCG <5,000	HCG >5,000
Able to comply with Methotrexate treatment and follow up	Unable to comply with Methotrexate treatment and/or follow up
No fetal cardiac activity on ultrasound	Fetal cardiac activity present on ultrasound

This patient has an assumed ectopic pregnancy due to the positive pregnancy test and hemodynamic instability. A transvaginal ultrasound (Choice C) would help definitively diagnose the patient with a ruptured ectopic pregnancy, but this should not delay consultation with the OBGYN team for definitive surgical management. Methotrexate (Choice A) is a medical treatment for ectopic pregnancy, but Methotrexate is contraindicated in ruptured ectopic due to the need for surgical treatment and intra-abdominal hemorrhage control. IV antibiotics (Choice B) are often given preoperatively for infection prophylaxis (prevention), but this is not a crucial next step. This patient is in shock and needs operative management. The best next step is OBGYN consultation for operative management **(Choice D)**.

References

- McCarty, M. (2017). Ectopic pregnancy. CORE-EM. https://coreem.net/core/ectopic-pregnancy/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Explanation – Question 89

The chart below outlines the pertinent causes of shortness of breath for the emergency practitioner to know.

	Selected Causes of Shortness of Breath (Dyspnea)
Pulmonary	Tension pneumothorax, pneumonia, empyema, pleural effusion, pulmonary edema, asthma, COPD
Cardiovascular	Acute coronary syndrome (i.e., STEMI), pulmonary embolism, cardiac tamponade, Decompensated Congestive Heart Failure (acute pulmonary edema)
Endocrine	Diabetic ketoacidosis (Kussmaul breathing)
Toxicologic	Salicylate overdose, or any ingestion that causes a severe metabolic acidosis
Neurologic	Intracranial hemorrhage, Stroke, Spinal cord injury, Guillain-Barre syndrome, Myasthenia Gravis crisis (myasthenic crisis)
Hematologic	Severe anemia (i.e., GI bleeding, trauma, miscarriage, post-partum hemorrhage, ruptured ectopic pregnancy)
Musculoskeletal	Rib fracture, flail chest
Psychiatric	Anxiety, Panic attack
Airway Problem	Foreign body, epiglottitis, anaphylactic shock (laryngeal swelling), expanding neck hematoma

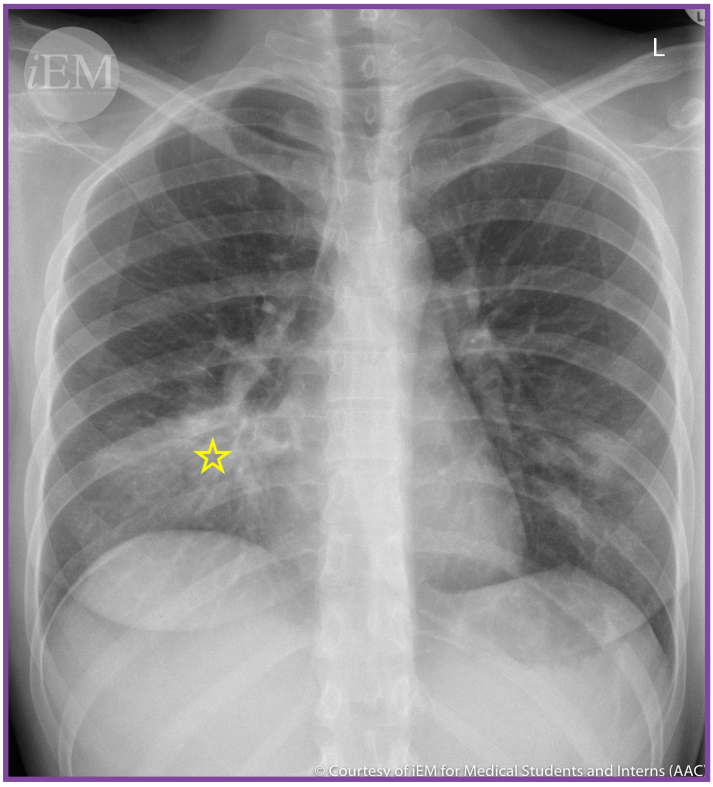
This patient arrives to the Emergency department with acute shortness of breath, an urticarial rash, hypotension, tachycardia, swelling of the lips and tongue, and wheezing on lung exam. This patient is in anaphylactic shock and requires prompt treatment with Epinephrine. Anaphylaxis is an IgE-mediated life-threatening allergic reaction that by definition affects two or more body systems (i.e., skin/mucosa, pulmonary, cardiovascular, gastrointestinal, etc.). This patient has involvement of the skin (urticarial rash, mucosal swelling), cardiovascular system (hypotension and tachycardia), and pulmonary system (wheezing). Symptoms of anaphylaxis may include urticaria, shortness of breath, wheezing, facial or airway swelling, vomiting or diarrhea, and abdominal pain.

Anaphylaxis is a clinical diagnosis and does not require vital signs to be unstable in order to be diagnosed. Once diagnosed, the most time-sensitive and lifesaving treatment is Epinephrine. The recommended initial dose for Epinephrine is 0.3-0.5 mg intramuscularly in the thigh for adults. Epinephrine doses can be repeated every 5-15 minutes if there is no improvement after the initial dose. Antihistamines, like Diphenhydramine (Choice D) or famotidine may be helpful as adjunctive treatments, but they are not lifesaving. Steroids, like Dexamethasone (Choice C), are also routinely given in anaphylaxis with the theory that they can prevent "rebound" allergic reactions. Again, steroids are not acutely lifesaving and should be given after IM epinephrine. IV Epinephrine can be given in a patient unresponsive to IM Epinephrine at a dose of 1-5mcg/min. A dose of IV Epinephrine 1mg (1000 mcg) (Choice A) is the dose of Epinephrine used during cardiac arrest and is too high of a dose to use in anaphylaxis. The best initial step in management is IM Epinephrine 0.3 mg **(Choice B)**.

References

- Sher, H. (2016). Anaphylaxis. CORE-EM. https://coreem.net/core/anaphylaxis/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

The chart on page 151 outlines the pertinent causes of shortness of breath for the emergency practitioner to know. This patient arrives to the Emergency department with shortness of breath, productive cough, and fever for five days. On exam, the patient is febrile, tachycardic, and has a low SpO2 on room air. The lung exam demonstrates focal rhonchi at the right base. In addition, the chest X-ray demonstrates a consolidation at the right middle lobe that obscures the right heart border. The consolidation is highlighted with a yellow star in the patient's X-ray below.



Lung consolidations have multiple causes, including pneumonia, malignancy, heart failure, pulmonary emboli, and septic emboli from endocarditis. Septic pulmonary emboli (Choice A) can present with cough, fever, and difficulty breathing, but often have multiple foci of consolidations on chest X-ray. This patient has a single area of consolidation. This patient also lacks the typical risk factors for septic emboli, like IV drug use, recent dental procedures, structural heart disease, or prosthetic heart valves. An infected pleural effusion (Choice B), also known as an empyema, is shown as a blunted or hazy right costo-diaphragmatic angle. This patient's X-ray shows no fluid in both costo-diaphragmatic recesses to indicate the presence of a pleural effusion.

A pulmonary embolism (Choice D) often presents with clear lungs on auscultation and a normal chest X-ray. However, if the pulmonary embolism progresses to a pulmonary infarct, a wedge-shaped opacity can be seen on the X-ray. This patient's X-ray lacks this finding. The most likely cause for this patient's symptoms is right middle lobe pneumonia **(Choice C)**. She should receive IV fluids, antipyretics, supplemental oxygen, and IV antibiotics.

References

- Long, DA & Long, B. (2016). Pneumonia mimics: Pearls and pitfalls. EM Docs. http://www.emdocs.net/pneumonia-mimics-pearls-and-pitfalls/
- Turchiano, M. (2017). Dyspnea. CORE-EM. https://coreem.net/core/dyspnea/

Question 91

A 45-year-old man presents to the Emergency Department complaining of upper abdominal pain and two episodes of hematemesis over the last 6 hours. He denies any fevers, syncope, blood in the stool, diarrhea, or daily alcohol use. He has no known medical or surgical history. He takes daily vitamins and ibuprofen for occasional back pains. On examination, his temperature is 37°C, blood pressure 110/60 mmHg, pulse 110 beats/min, respiratory rate 18 breaths/min, and oxygen saturation is 99% on room air.

Which of the following is the most likely cause for this patient's condition?

A. Esophageal varices

B. Gastric malignancy

C. Peptic ulcer disease

D. Gastroesophageal Reflex Disease (GERD)

Question 92

A 75-year-old man presents to the Emergency Department complaining of 6 episodes of loose stool with bright red blood over the last three days. He denies any pain with defecation, abdominal pain, vomiting, constipation, prior gastrointestinal bleeds, fevers, recent travel, or anticoagulant use. His medical history includes hypertension, diabetes, and hyperlipidemia. His surgical history includes a previous appendectomy. On examination, his temperature is 37°C, blood pressure 90/50 mmHg, pulse 115 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft, nondistended, and nontender.

Which of the following is the most likely cause of this patient's condition?

A. Mesenteric ischemia

B. Colon cancer

C. Peptic ulcer disease

D. Diverticulosis

Question 93

A 80-year-old man presents to the Emergency Department complaining of generalized abdominal pain, multiple bloody stools, and dizziness for three days. He describes the stool as loose and mixed with bright red blood. He denies any rectal pain, chest pain, or vomiting. His medical history includes hypertension, hyperlipidemia, atrial fibrillation, and coronary artery disease. He takes Warfarin (Coumadin) daily. On examination, his temperature is 37°C, blood pressure 80/40 mmHg, pulse 135 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 97% on room air. The abdomen is soft, nondistended, and diffusely tender. The conjunctiva is pale. Two large-bore IV lines are placed in the extremities.

Which of the following is the most appropriate next step in management?

A CT Angiogram of the abdomen and pelvis

B Gastroenterology consultation for colonoscopy

C IV Pantoprazole infusion

D Packed Red Blood Cells

Question 94

A 73-year-old man presents to the Emergency Department complaining of multiple bright red bloody stools over the last day. He denies any abdominal pain, fevers, or vomiting. His medical history includes hypertension, diabetes, and atrial fibrillation. He takes Warfarin (Coumadin) daily. On examination, his temperature is 37°C, blood pressure 85/40 mmHg, pulse 140 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 97% on room air. The patient is awake and oriented but appears weak and pale. Two large-bore IV lines are placed in the extremities and packed red blood cells are initiated. Select blood test results for this patient are below.

Test	Test Result	Reference Range
WBC Count	4.5	4.0 – 10.5 X 103/mL
Hemoglobin	5.3	13.0 - 18.0 g/dL
Hematocrit	15.9	39.0 - 54.0 %
Platelets	138	140 - 415 x 103/mL

Which of the following is the most appropriate next step in management for this patient's condition?

A Platelet transfusion

B IV Vitamin K and IV Fresh Frozen Plasma

C IV Vitamin K only

D Await INR value, and administer IV Vitamin K if INR is greater than 10

Question 95

A 26-year-old female presents to the Emergency Department complaining of 4 episodes of bright red bloody stools over the last two days. She admits to lower abdominal pain and tactile fevers. She denies vomiting or rectal pain. She has no past medical or surgical history and takes no medications daily. On examination, her temperature is 38°C, blood pressure 110/70 mmHg, pulse 115 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft, nondistended, and tender in the left lower and upper quadrants. Select blood test results for this patient are below.

Test	Test Result	Reference Range
WBC Count	16.2	4.0 – 10.5 X 103/mL
Hemoglobin	10.8	13.0 - 18.0 g/dL
Hematocrit	32.4	39.0 - 54.0 %
Platelets	220	140 - 415 x 103/mL

Which of the following is the most likely diagnosis for this patient's condition?

A. Diverticulosis
B. Colon malignancy
C. Ischemic colitis
D. Ulcerative colitis

Question 96

A 62-year-old female presents to the Emergency Department complaining of upper abdominal pain and two episodes of hematemesis 2 hours prior to arrival. She denies chest pain or fevers. Her medical history includes hypertension, hepatitis C virus, diabetes, and liver cirrhosis. On examination, her temperature is 37°C, blood pressure 85/40 mmHg, pulse 125 beats/min, respiratory rate 22 breaths/min, and oxygen saturation is 96% on room air. The abdomen is soft, nontender, and markedly distended with a palpable fluid wave. The conjunctiva is pale. While you examine the patient, she has a large volume of hematemesis, and the decision is made to intubate the patient. Two large-bore IV lines are placed and blood products are being prepared for administration.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Abdominal paracentesis
B. IV Ceftriaxone
C. IV Tranexamic acid
D. General surgery consultation

Question 97

A 55-year-old female presents to the Emergency Department after multiple episodes of hematemesis prior to arrival. Her medical history includes alcoholic liver cirrhosis, diabetes, and esophageal varices. On examination, her temperature is 37°C, blood pressure 98/50 mmHg, pulse 120 beats/min, respiratory rate 24 breaths/min, and oxygen saturation is 95% on room air. The patient begins to have additional episodes of hematemesis in the Emergency Department and appears disoriented, somnolent, and pale. Two large-bore IV lines are placed and blood products are being prepared for administration.

Which of the following is the most appropriate next step in management for this patient's condition?

A. Sengstaken-Blakemore tube

B. IV Pantoprazole

C. Endotracheal intubation

D. Cricothyrotomy

Question 98

A 66-year-old male presents to the Emergency Department for one day of epigastric abdominal pain and several episodes of hematemesis. The patient denies syncope, fevers, or blood in the stool. His medical history includes hypertension, hyperlipidemia, cholelithiasis, and rheumatoid arthritis. He recently had an arthritis flare and has been taking daily oral steroids and acetaminophen (paracetamol) for the last two weeks. On examination, his temperature is 37°C, blood pressure 90/50 mmHg, pulse 118 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 99% on room air. The abdomen is soft with tenderness in the epigastrium and left upper quadrant. The conjunctiva appears pale.

Which of the following is the most likely cause for this patient's condition?

A. Fatty meals

B. Bacteremia

C. Systemic steroids

D. Acetaminophen use

Question 99

A 60-year-old male presents to the Emergency Department after 1 episode of hematemesis 3 hours ago. The patient denies chest pain, melena, or syncope. His medical history includes hypertension, hyperlipidemia, and alcohol abuse. On examination, his temperature is 37°C, blood pressure 98/50 mmHg, pulse 108 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The patient is awake and alert in bed. IV access is established and labs are drawn. The patient's lab results are below.

Test	Test Result	Reference Range
BUN	36.2	5 -18 mg/dL
Creatinine	1.1	0.7 – 1.2 mg/dL
Hemoglobin	9.2	13.0 - 18.0 g/dL
Hematocrit	27.6	39.0 - 54.0 %

Which of the following is the most appropriate advice for this patient's condition?

A Discharge with gastroenterology follow-up in 1 week

B Discharge with instructions to return if repeat hematemesis episodes

C Place a Sengstaken-Blakemore tube

D Admit for monitoring and endoscopy

Question 100

A 72-year-old male presents to the Emergency Department for one week of black-colored stools and generalized fatigue. The patient denies chest or abdominal pain, vomiting, or fevers. His medical history includes hypertension, diabetes, coronary artery disease, atrial fibrillation, and a prior cerebrovascular accident. He takes Aspirin and Warfarin (Coumadin) daily. On examination, his temperature is 37°C, blood pressure 118/70 mmHg, pulse 110 beats/min, respiratory rate 20 breaths/min, and oxygen saturation is 98% on room air. The abdomen is soft and nontender. The stool on digital rectal examination is soft and melanotic.

Which of the following is the most appropriate next step in management for this patient's condition?

A Start 1 Liter of normal saline

B Consult gastroenterology for emergent endoscopy

C Consult surgery for gastrectomy

D Administer 1 gm of Ceftriaxone

This patient arrives to the Emergency Department with upper abdominal pain and hematemesis. He occasionally takes ibuprofen, a non-steroidal anti-inflammatory drug (NSAID), which is a risk factor for GI bleeding. His examination shows tachycardia. This patient likely has an upper gastrointestinal bleed, given his signs and symptoms. Please refer to the chart below for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

Upper GI Bleeding (UGIB)	Lower GI Bleeding (LGIB)
Definition of UGIB: Source of bleeding is PROXIMAL to the Ligament of Treitz (junction of the duodenum + jejunum)	**Definition of LGIB:** Source of bleeding is DISTAL to the Ligament of Treitz (junction of the duodenum + jejunum)
Causes of UGIB	**Causes of LBIG**
Peptic ulcer disease* Gastritis Esophagitis Gastro-esophageal varices Mallory-Weiss tear Malignancy Aorto-enteric fistula	Diverticulosis* Hemorrhoids or Anorectal fissures Colitis (Inflammatory, Infectious, or Ischemic) Angiodysplasia Meckel's diverticulum Malignancy
Signs + Symptoms	**Signs + Symptoms**
Hematemesis or "coffee-ground" emesis Melena Hematochezia (if brisk UGIB) Abdominal pain (upper or diffuse) Syncope or presyncope Signs of shock (tachycardia, hypotension) Conjunctival pallor	Bright red blood per rectum Hematochezia Abdominal pain (lower or diffuse) Syncope or presyncope Signs of shock (tachycardia, hypotension) Conjunctival pallor
Treatment	**Treatment**
Airway: Sit upright to prevent aspiration. Intubate if needed to protect airway. **Breathing**: Supplemental O2 as needed. **Circulation**: • Place 2 large bore IVs. • Administer blood products if patient is in shock, or if Hgb <7 g/dL. • Reversal of anticoagulant medications. • Place Blakemore tube to tamponade variceal bleeds. **Other pharmacologic treatments:** 1. Proton pump inhibitors (i.e., pantoprazole) • Decreases gastric acid production • Prevents ulcer re-bleeding • Most helpful for peptic ulcer disease 2. Octreotide or Somatostatins • Cause vasoconstriction and decreased blood flow to splanchnic circulation • Most helpful for variceal bleeding 3. Antibiotics (i.e., ceftriaxone) • Reduce mortality in UGIB patients with liver cirrhosis	**Airway**: Sit upright to prevent aspiration. Intubate if needed to protect airway. **Breathing**: Supplemental O2 as needed. **Circulation**: • Place 2 large bore IVs. • Administer blood products if patient is in shock, or if Hgb <7 g/dL. • Reversal of anticoagulant medications. **Other pharmacologic treatments:** 1. Unlike in UGIB, proton pump inhibitors, octreotide, and antibiotics generally do not have a role in LGIB. 2. Consider antibiotic use in infectious conditions that can cause LGIB, like infectious colitis.

All choices above are potential causes of upper GI bleeding, except GERD (Choice D). Erosive gastritis and esophagitis can cause an upper GI bleed, but GERD is not a cause of upper GI bleed. The patient lacks risk factors for esophageal varices (Choice A), such as chronic liver disease, cirrhosis, or alcohol abuse. Gastric malignancy (Choice B) is possible, but less likely given the patient's young age and lack of risk factors mentioned in the question stem for gastric malignancy (i.e., prior H. pylori infection, tobacco smoking, chronic gastritis, weight loss, lymphadenopathy, etc.). The most common worldwide cause of upper GI bleeding is peptic ulcer disease **(Choice C)**.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
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- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 92

This elderly patient arrives to the Emergency Department with painless hematochezia. His exam shows borderline hypotension, tachycardia, and a normal abdominal exam. This patient most likely has a lower gastrointestinal bleed based on his signs and symptoms. A brisk (fast) upper GI bleed is also possible but is less likely. Please refer to the chart on page 158 for a list of causes of GI bleeding, GI bleeding signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

All choices listed above are potential causes of bright red bloody stools. Peptic ulcer disease (Choice C) is the most common cause of upper GI bleeding worldwide, not lower GI bleeding. However, a profusely bleeding peptic ulcer can cause rapid blood transit through the GI tract to form hematochezia rather than melena. The patient lacks any risk factors or symptoms of peptic ulcer disease, such as upper abdominal pain, hematemesis, NSAID use, or prior H. pylori infection. Ischemic colitis, or mesenteric ischemia (Choice A), is often associated with abdominal pain and cardiac risk factors (i.e., atrial fibrillation). Colon cancer (Choice B) is also possible, but typically colon malignancy causes slow, chronic bleeding rather than acute large-volume bloody stools with signs of shock as in this patient. The most common cause of lower GI bleeding worldwide is diverticulosis **(Choice D).** This is the most likely diagnosis in this patient with painless hematochezia.

References

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- Thomas L & Thompson L. (2019). GI bleed. Society of Academic Emergency Medicine. https://www.saem.org/about-saem/academies-interest-groups-affiliates2/cdem/for-students/online-education/m4-curriculum/group-m4-approach-to/gi-bleed
- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 93

This patient arrives to the Emergency Department with bright red bloody stools and generalized abdominal pain. His exam shows hypotension, tachycardia, a diffusely tender abdomen, and pale conjunctiva. He also takes warfarin daily for anticoagulation. This patient is in hemorrhagic shock due to a lower gastrointestinal bleed. This patient's condition may be due to coagulopathy from his warfarin (i.e., supratherapeutic INR), diverticulosis, ischemic colitis (i.e., mesenteric ischemia), and other conditions. Initial management of this unstable patient should include management of the airway, breathing, and circulation ("ABCs"). This includes aggressive and prompt treatment of the patient's hypotension and tachycardia. Please refer to the chart on page 158 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

A CT Angiogram of the abdomen and pelvis (Choice A) may be helpful in clarifying the etiology and site of the patient's bleeding, but this is not the best next step in management. The patient's shock state should first be managed before imaging studies. Gastroenterology consultation for colonoscopy (Choice B) may be important later in this patient's management, but it is not the best next step in management. His shock state should be treated prior to calling any consultants. An IV Pantoprazole infusion (Choice C) is helpful in upper GI bleeds due to peptic ulcer disease. Proton pump inhibitor medications, like pantoprazole, help reduce findings of ulcer bleeding during endoscopy. Proton pump inhibitor use has been controversial in upper GI bleeds as there is no evidence that their use decreases mortality, decreases blood product requirements, or ulcer rebleeding, but these medications are often given due to their generally small risk profile. The best next step for this patient in hemorrhagic shock is administration of packed red blood cells (Choice D). He also should have reversal of his warfarin with IV Vitamin K and fresh frozen plasma to prevent continued bleeding.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Department of Emergency Medicine. (2015). Proton pump inhibitors in upper GI bleeds. Washington University School of Medicine in St. Louis. https://emergencymedicine.wustl.edu/items/proton-pump-inhibitors-in-upper-gi-bleeds/
- Thomas L & Thompson L. (2019). GI bleed. Society of Academic Emergency Medicine. https://www.saem.org/about-saem/academies-interest-groups-affiliates2/cdem/for-students/online-education/m4-curriculum/group-m4-approach-to/gi-bleed
- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 94

This patient arrives to the Emergency Department with bright red bloody stools in the setting of warfarin use. His exam shows hypotension and tachycardia. The laboratory results show low hemoglobin and hematocrit, but no INR or other coagulation studies are provided. This patient is in hemorrhagic shock due to a lower gastrointestinal bleed. This patient's condition may be due to coagulopathy from his Warfarin (i.e., supratherapeutic INR), diverticulosis, or other conditions. Initial management of this unstable patient should include management of the airway, breathing, and circulation ("ABCs"). This includes aggressive and prompt treatment of the patient's hypotension and tachycardia and reversal of the patient's anticoagulation. Please refer to the chart on page 158 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

This patient's platelet level is just below the lower limit of normal, so administration of a platelet transfusion (Choice A) would not be the next best step. Platelet administration should be considered if the platelet count is below 50,000-100,000, or if a massive transfusion protocol is initiated to prevent coagulopathy. No INR value is provided in the question stem, but prompt reversal of Warfarin should not be delayed for an INR level (Choice D). Reversal of Warfarin should be promptly initiated when a patient is unstable (i.e., hypotensive GI bleeding, traumatic wound hemorrhage, intracranial bleeding, etc.). Medication reversal in these settings includes both IV Vitamin K 10mg and IV Fresh Frozen Plasma 10-20cc/kg. IV Vitamin K helps reverse the Vitamin K antagonistic effect of Warfarin, but it does not acutely provide new Vitamin K-dependent coagulation factors (Factors X, V, II, VII). IV Vitamin K gives the liver the 'materials' needed to regenerate these coagulation factors, but this process takes time. Fresh frozen plasma contains 'ready-to-use' coagulation factors that will help control the hemorrhage acutely. For this reason, vitamin K and FFP are given together in an unstable patient. An alternative to fresh frozen plasma (FFP) is prothrombin complex concentrate (PCC), which is a concentrated version of coagulation factors. PCC is not broadly available in all countries, and is generally more expensive than FFP. The management of stable patients with a supratherapeutic INR includes holding warfarin doses and sometimes providing PO Vitamin K, depending on the INR level. Administration of IV Vitamin K only (Choice C) is not the correct treatment in this scenario. IV Vitamin K and Fresh Frozen Plasma **(Choice B)** is the best next step to reverse this patient's anticoagulant.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Farkas J. (2019). Anticoagulant reversal. EMCRIT: The Internet Book of Critical Care. https://emcrit.org/ibcc/reverse/
- Thomas L & Thompson L. (2019). GI bleed. Society of Academic Emergency Medicine. https://www.saem.org/about-saem/academies-interest-groups-affiliates2/cdem/for-students/online-education/m4-curriculum/group-m4-approach-to/gi-bleed
- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 95

This patient arrives to the Emergency Department with bright red bloody stools and lower abdominal pain. The exam shows fever, tachycardia, and left-sided abdominal tenderness. The laboratory results provided show leukocytosis and anemia. This patient likely has a lower GI bleed based on her signs and symptoms. Please refer to the chart on page 158 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

All choices provided are causes of lower GI bleeding and are possible in this patient. However, that patient's signs, symptoms, and risk profile make certain diagnoses less likely than others. Diverticulosis (Choice A) is the most common cause of lower GI bleeding. Diverticulosis often occurs in older patients and should not be associated with pain or fever, which support a diagnosis of an inflammatory or infectious etiology (i.e., diverticulitis, Shigellosis, ulcerative colitis, chron's disease, etc.). This patient is young and has fever and leukocytosis, making diverticulosis less likely. Colon malignancy (Choice B) is also possible but is less likely given the patient's young age, the presence of fever, and the acute onset of symptoms over two days. Colon malignancy tends to cause slow GI bleeding over a longer period of time rather than acutely over two days. Ischemic colitis (Choice C), such as mesenteric ischemia, is less likely in a young patient without any cardiac risk factors or recent abdominal surgeries. Ulcerative colitis (Choice D) is the most likely diagnosis in this scenario. The

peak incidence of ulcerative colitis occurs in the second and third decades of life, and women are more likely than men to have this diagnosis. Definitive diagnosis requires a biopsy and colonoscopy, but a CT scan of the abdomen and pelvis can show findings consistent with ulcerative colitis for a new diagnosis. Treatment of an ulcerative colitis flare includes general supportive care, IV steroids, and IV antibiotics if there is a concern for a concurrent infectious process. Intestinal perforation and toxic megacolon also should be evaluated with CT imaging.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Trueblood W & Simon E. ()2016). Inflammatory bowel disease in the Emergency department. EMDocs. http://www.emdocs.net/inflammatory-bowel-disease-emergency-department/

Explanation – Question 96

This patient arrives to the Emergency Department with upper abdominal pain and hematemesis. The exam demonstrated hypotension, tachycardia, pale conjunctiva, and abdominal ascites. The patient decompensates during the exam requiring endotracheal intubation for airway protection. This patient has an upper GI bleed, most likely from gastro-esophagal varices, given her history of liver cirrhosis and stigmata of chronic liver disease. Gastro-esophageal (GE) varices are dilated blood vessels at the GE junction that result from portal hypertension. Variceal bleeding can be catastrophic and cause hemorrhagic shock and problems with airway patency as seen in this scenario. The management of GE variceal bleeding, like other GI bleeds, begins with management of the "ABCs" (Airway, Breathing, and Circulation). Unlike in other causes of upper GI bleeds, IV antibiotics and IV octreotide are used in GE variceal bleeds. IV antibiotics have a mortality benefit when used in this setting. First-line antibiotics are IV ceftriaxone or IV ciprofloxacin. Early gastroenterology consultation is another important component of GE variceal bleed management for definitive diagnosis and treatment with variceal banding or ligation.

An abdominal paracentesis (Choice A) is not the best next step in this unstable cirrhotic patient. Antibiotics are routinely given in gastro-esophageal variceal bleeds due to their mortality benefit, so there is no need for an emergent paracentesis to evaluate for spontaneous bacterial peritonitis (SBP) with an ascitic fluid sample. IV Tranexamic acid (Choice C) is an anti-fibrinolytic agent with pro-coagulative effects. Its use is recommended in post-partum hemorrhage and traumatic hemorrhages, but it has no utility in the setting of GI bleed. Early gastroenterology consultation for endoscopy is preferred over general surgery consultation (Choice D). Surgery consultants can assist in a TIPS procedure (Transjugular intrahepatic portosystemic shunt) to reduce portal hypertension, esophageal resection, or gastrectomy, but less invasive endoscopic therapies with GI specialists are preferred over these procedures. IV Ceftriaxone **(Choice B)** is the best next step in this scenario due to the mortality benefit of antibiotics in chronic liver disease patients with variceal bleeds. Please see the chart on page 158 for further details on general GI bleed causes, signs and symptoms, and ED management.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Long B. (2018). EM@3AM: Gastroesophageal varices. emDocs. http://www.emdocs.net/em3am-gastroesophageal-varices/
- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 97

This patient arrives to the Emergency department after multiple episodes of hematemesis. Her exam shows tachycardia, borderline hypotension, and mild tachypnea. While in the Emergency Department, the patient decompensates after more hematemesis episodes and develops altered mental status. This patient has an upper GI bleed, most likely from a gastroesophageal variceal bleed. Gastroesophageal (GE) varices are dilated blood vessels at the GE junction that result from portal hypertension. Variceal bleeding can be catastrophic and cause hemorrhagic shock and problems with airway patency as seen in this scenario. The management of GE variceal bleeding, like other GI bleeds, begins with management of the "ABCs" (Airway, Breathing, and Circulation). Unlike in other causes of upper GI bleeds, IV antibiotics and IV octreotide are used in GE variceal bleeds. IV antibiotics have a mortality benefit when used in this setting. Early gastroenterology consultation is another important component of GE variceal bleed management for definitive diagnosis and treatment with variceal banding or ligation. Please see the chart on page 158 for further details on general GI bleed causes, signs and symptoms, and ED management.

This patient with a depressed mental status needs to have a definitive airway established to prevent aspiration with bloody vomitus. IV Pantoprazole (Choice B) is used in upper GI bleeds from peptic ulcers but has no role in this acutely ill variceal bleed patient. Therefore, the airway should be established prior to medications, such as pantoprazole. A cricothyrotomy (Choice D) would establish an airway, but this is an invasive approach to airway management and not the best approach for this patient. A cricothyrotomy involves piercing a needle or scalpel in the anterior neck (cricothyroid membrane) to establish an airway surgically. This procedure is performed in special situations where a patient cannot be intubated through the trachea (i.e., angioedema of the lips and tongue, facial mass, facial trauma) and cannot ventilate independently (i.e., depressed mental status).

This patient does not meet the criteria for this invasive procedure. Endotracheal intubation should be attempted first on this patient. A Sengstaken-Blakemore tube (Choice A) is a specialized oro-gastric tube with a gastric and esophageal balloon. Once placed correctly, the balloons on the tube can be inflated to tamponade any bleeding variceal vessels in the distal esophagus or stomach. This tube should be placed only after intubating a patient and used as a last-resort measure before endoscopic treatment. The best next step in management of this patient is to perform endotracheal intubation **(Choice C)** for airway protection.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Long B. (2018). EM@3AM: Gastroesophageal varices. emDocs. http://www.emdocs.net/em3am-gastroesophageal-varices/
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Explanation – Question 98

This man presents to the Emergency department with epigastric pain and hematemesis. His exam shows hypotension, tachycardia, pale conjunctiva, and a tender epigastrium and left upper quadrant. This patient likely has an upper GI bleed based on his signs and symptoms. Please refer to the chart on page 158 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

Risk factors for GI bleeding include alcohol use, anticoagulant use, NSAID (non-steroidal anti-inflammatory drug) use (i.e., ibuprofen, aspirin, naproxen), recent gastrointestinal surgery or procedures, prior GI bleeds, and a history of conditions that are associated with GI bleeds (i.e., gastritis, peptic ulcers, H. Pylori infection, ulcerative colitis, Chron's disease, hemorrhoids, diverticulosis, or GI tract cancers). Fatty meals (Choice A) can trigger gastroesophageal reflux disorder (GERD) symptoms or biliary colic symptoms from cholelithiasis. However, fatty meals do not increase the risk of GI bleeding. Physiological stress, such as sepsis or bacteremia (Choice B), can increase the risk of GI bleeding. This patient does not have any infectious exam signs or symptoms that would support the presence of bacteremia. Acetaminophen use (Choice D) can cause liver failure if taken in excess, but acetaminophen does not cause GI bleeding. NSAIDs, unlike Tylenol, are associated with GI bleeding. Systemic steroid use **(Choice C)** can increase the risk for GI bleeding and is the likely cause of this patient's upper GI bleed.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Thomas L & Thompson L. (2019). GI bleed. Society of Academic Emergency Medicine. https://www.saem.org/about-saem/academies-interest-groups-affiliates2/cdem/for-students/online-education/m4-curriculum/group-m4-approach-to/gi-bleed
- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 99

This patient arrives to the Emergency department after a single hematemesis episode. On physical examination, he has borderline low blood pressure and tachycardia. The laboratory results demonstrate an elevated BUN and low hemoglobin and hematocrit. The patient's vital signs, in combination with the laboratory values, point towards a diagnosis of an upper GI bleed with early signs of hemorrhagic shock. The history of alcohol abuse also should raise concern for possible gastro-esophageal variceal bleeding as the cause of GI bleeding. Please refer to the chart on page 158 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

Although this patient is not acutely unstable, his vital signs are abnormal, and he should receive volume resuscitation and close observation in the Emergency Department. After initial resuscitation and treatment, it is sometimes difficult to know the best disposition for the patient (admit versus discharge). The Glasgow-Blatchford Score is a validated risk satisfaction tool used to assist in determining the disposition of patients with an upper GI bleed. The scoring criteria and instructions on how to use the score are below.

Glasgow-Blatchford Score
A validated risk stratification tool for patients with upper GIB

Scoring Criteria	Numerical Score
BUN (mg/dL)	
<18.2	0
18.2-22.3	+2
22.4-28	+3
28-70	+4
>70	+6
Hemoglobin (g/dL) for men	
>13	0
12-13	+1
10-12	+3
<10	+6
Hemoglobin (g/dL) for women	
>12	0
10-12	+1
<10	+6
Systolic blood pressure (mmHg)	
>110	0
100-109	+1
90-99	+2
<90	+3
Other criteria	
Pulse >100 beats/min	+1
Melena present	+1
Syncope	+2
Liver disease history	+2
Cardiac failure history	+2
Instructions: Low risk = Score of 0. Any score higher than 0 is high risk for needing intervention: transfusion, endoscopy, or surgery. Consider admission for any score over 0.	

This patient has a Glasgow-Blatchford score of 15 and should not be discharged home. A plan to discharge with gastroenterology follow-up in 1 week (Choice A) or discharge with instructions to return if there are repeat hematemesis episodes (Choice B) should not be followed. This patient may have future hematemesis episodes in the Emergency Department, be at risk for aspiration, require endotracheal intubation, and become more hypotensive. A Sengstaken-Blakemore tube (Choice C) is a specialized oro-gastric tube with a gastric and esophageal balloon. Placement of this tube is considered an invasive procedure that is only used after a patient has been endotracheally intubated to prevent aspiration. Once placed correctly, the balloons in the tube can be inflated to tamponade any bleeding variceal vessels in the distal esophagus or stomach. This tube is used as a last resort measure before endoscopic treatment for presumed gastro-esophageal variceal bleeds. The best advice for this patient would be to admit the patient for monitoring and endoscopy **(Choice D)**.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/

- MDcalc. Glasgow-Blatchford bleeding score (GBS). https://www.mdcalc.com/glasgow-blatchford-bleeding-score-gbs
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- White K (2017). EM@3AM: GI bleed. emDocs. http://www.emdocs.net/em3am-gi-bleed/

Explanation – Question 100

This patient arrives to the Emergency department with one week of melena and fatigue. His medication list includes an antiplatelet and anticoagulant medication. There is tachycardia and melena noted on examination. This patient likely has an upper GI bleed based on his signs and symptoms with peptic ulcer disease as the most common cause. The patient's anticoagulation is a risk factor for GI bleeding and is an important contributing factor in this scenario. Please refer to the chart on page 159 for a list of GI bleeding causes, signs and symptoms, and the initial Emergency Department treatment of GI bleeding.

Gastroenterology consultation for emergent endoscopy (Choice B) is unnecessary as the patient is not acutely unstable. He may need a diagnostic and therapeutic endoscopy during an inpatient admission, but the GI consultants do not need to be called emergently for this procedure. An acutely unstable upper GI bleed patient, such as a patient with hemodynamic instability, requiring intubation for airway protection, receiving multiple blood product transfusions, or with brisk (rapid) bleeding on exam, should prompt GI consultation for an emergent endoscopy for source control. Surgery consultation for gastrectomy (Choice C) is not a first-line treatment for upper GI bleeding. Gastroenterologists should first perform a diagnostic and therapeutic endoscopy for most upper GI bleed patients. Surgical esophageal transection, gastrectomy, colectomy, and other surgical procedures are last-resort measures to control GI bleeding. Administration of IV Ceftriaxone (Choice D) is not needed in this scenario and should not be given routinely in upper GI bleeds. This patient has no infectious signs or symptoms. Antibiotics, such as Ceftriaxone or quinolones, should be given to upper GI bleed patients with chronic liver disease (i.e., cirrhosis) or presumed gastroesophageal variceal bleeds. Antibiotics have been found to have a mortality benefit in this patient population with GI bleeds. The best next step in management is to treat the patient's tachycardia with normal saline **(Choice A)** for volume resuscitation. This patient may eventually need blood products, but crystalloid IV fluids are okay to start until the Complete Blood Count results return. This patient is not in overt hemorrhagic shock, so blood products can be held until there is evidence that the hemoglobin is below 7 g/dL. Reversal of the patient's anticoagulation with Vitamin K and fresh frozen plasma may also be needed depending on the INR level. Reversal can wait until coagulation studies are complete since the patient is not acutely unstable. An unstable patient should have their anticoagulant reversed immediately.

References

- Carrol M, Mudan G, & Bentley S. Gastrointestinal bleeding. International Emergency Medicine Education Project. https://iem-student.org/gi-bleeding/
- Farkas J. (2019). Anticoagulant reversal. EMCRIT: The Internet Book of Critical Care. https://emcrit.org/ibcc/reverse/
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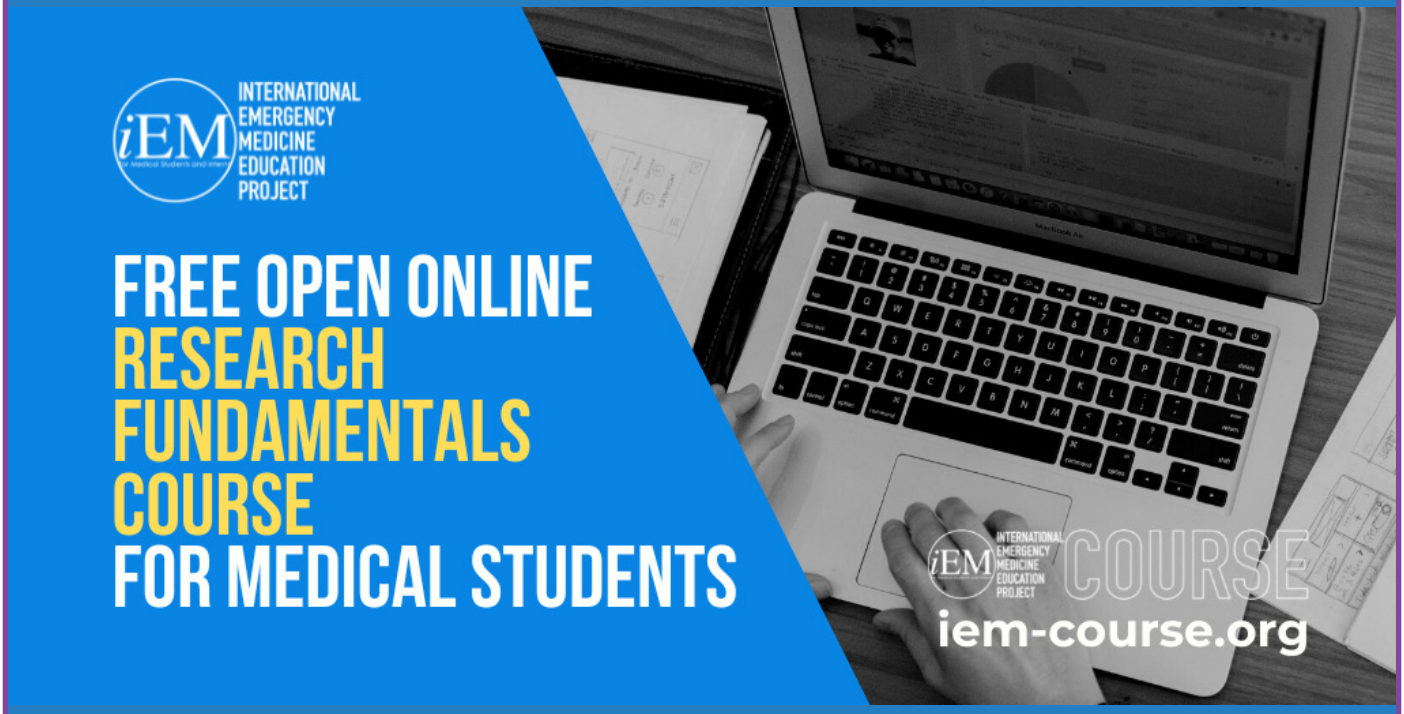
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Question Information

Q#	Complaints	Domain	Cognitive Level
1	Central chest and midline back pain	Dignosis, Therapy	Analysis
2	Unwitnessed syncopal episode	Dignosis, Therapy	Application
3	Altered Mental Status	Therapy	Application
4	Left-sided headache and nausea	Investigation	Comprehension
5	Abdominal pain after a motor vehicle accident	Investigation	Analysis
6	Altered mental status and fever	Pathogenesis	Analysis
7	Cough, fever, and generalized weakness	Therapy	Application
8	Altered mental status and agitation	Diagnosis	Comprehension
9	Agitated delirium	Therapy	Application
10	Acute onset palpitations and anxiety	Therapy	Application
11	Worsening substernal chest pain	Diagnosis, Therapy	Analysis
12	Central burning chest	Therapy, Complications	Application
13	5-minute episode of chest pain	Therapy	Application
14	Left-sided pleuritic chest pain	Therapy	Application
15	Right-sided pleuritic chest pain and mild shortness of breath	Investigation	Analysis
16	Sharp left-sided chest pain and shortness of breath	Therapy	Application
17	Intermittent palpitations for one day	Investigation	Comprehension
18	Pleuritic anterior chest pain	Therapy	Analysis
19	Burning substernal chest pain with nausea	Diagnosis	Comprehension
20	One week of shortness of breath, intermittent chest pains	Investigation	Application
21	Witnessed cardiac arrest	Therapy	Comprehension
22	Witnessed collapse outside of the hospital	Therapy	Application
23	Atraumatic pleuritic chest pain and dyspnea	Therapy	Synthesis
24	Feeling lightheaded and dizzy	Therapy	Analysis
25	Intermittent dizziness	Diagnosis	Comprehension
26	Sensation of “heart racing”	Therapy	Analysis
27	Constant palpitations for 4 hours	Therapy	Analysis
28	Fatigue, nausea, and palpitations	Diagnosis	Application
29	Severe vomiting, diarrhea, and fatigue	Therapy	Application
30	Witnessed collapse in a supermarket	Therapy	Application
31	Diffuse abdominal pain	Diagnosis	Comprehension

Q#	Complaints	Domain	Cognitive Level
32	Sharp epigastric abdominal pain	Therapy	Application
33	Diffuse abdominal pain and generalized weakness	Therapy	Analysis
34	Worsening constant right lower abdominal pain	Investigation	Application
35	Diffuse abdominal crampy pain	Pathogenesis	Analysis
36	Worsening right lower abdominal pain	Diagnosis	Comprehension
37	Generalized abdominal pain and distension	Therapy	Application
38	Intermittent upper abdominal pain	Diagnosis	Comprehension
39	Atraumatic right shoulder pain, vaginal bleeding	Therapy	Application
40	Constipation, anorexia, and lower left abdominal pain	Therapy	Application
41	Confusion and slurred speech	Therapy	Application
42	Altered mental status	Therapy	Application
43	Altered mental status and fever	Etiology	Analysis
44	Altered mental status and headache	Investigation	Application
45	Altered mental status	Therapy	Application
46	Altered mental status, lethargy, and myalgias	Therapy	Application
47	Altered mental status	Therapy	Application
48	Altered mental status	Diagnosis	Comprehension
49	Altered mental status while exercising in a park	Diagnosis	Comprehension
50	Altered mental status and combativeness	Therapy	Application
51	Fever, left flank pain	Diagnosis	Comprehension
52	Dyspnea and body pruritis	Therapy	Application
53	Posterior neck pain and a tingling sensation	Pathogenesis	Analysis
54	Shortness of breath and chest pain	Diagnosis	Application
55	Chest pressure	Pathogenesis	Application
56	Shortness of breath and right-sided chest pain	Diagnosis	Application
57	Dizziness, fatigue, nausea, and generalized abdominal pain	Pathogenesis	Application
58	Epigastric pain and 1 episode of hematemesis	Therapy	Application
59	Palpitations, generalized weakness	Pathogenesis	Application
60	Generalized weakness, nausea, and non-bloody vomiting	Diagnosis	Comprehension
61	Right-sided chest pain after a physical altercation	Diagnosis	Application
62	Altered mental status after high-speed motor vehicle accident	Diagnosis	Comprehension

Q#	Complaints	Domain	Cognitive Level
63	High-speed motor vehicle accident	Investigation	Application
64	Blunt trauma to the abdomen	Therapy	Application
65	Penetrating trauma to the abdomen	Investigation	Application
66	Stab wound to the left upper chest	Diagnosis	Comprehension
67	Stab wound to the left chest	Pathogenesis	Analysis
68	Fall down 5 stairs	Investigation	Application
69	Slip and fall onto a fish while boating	Therapy	Application
70	Cut his right forearm with a kitchen knife	Therapy	Knowledge
71	Lethargy	Therapy	Application
72	Severe agitation	Diagnosis	Comprehension
73	Ingestion of an unknown agent	Diagnosis	Application
74	Difficulty breathing, altered mental status, hypersalivation, and vomiting	Therapy	Application
75	Altered mental status after ingestion of an unknown agent	Diagnosis	Analysis
76	Ingesting pain medications as part of a suicide attempt	Therapy	Application
77	Altered mental status and tachypnea	Therapy	Application
78	Slurred speech and somnolence	Diagnosis	Comprehension
79	Altered mental status and hypotension after ingestion multiple pills	Therapy	Application
80	Dizziness after accidentally ingesting too many hypertension medications	Therapy	Application
81	Difficulty breathing started acutely while watching television	Diagnosis	Analysis
82	Difficulty breathing started when he woke up this morning	Diagnosis	Comprehension
83	Worsening shortness of breath, nausea, and generalized weakness	Therapy	Application
84	Worsening shortness of breath and generalized weakness	Therapy	Application
85	Shortness of breath for two days	Diagnosis	Comprehension
86	Acute onset shortness of breath	Therapy	Analysis
87	Shortness of breath and decreased exercise tolerance	Diagnosis	Comprehension
88	Shortness of breath and generalized abdominal discomfort	Therapy	Application
89	Shortness of breath and body rash	Therapy	Application
90	Shortness of breath, fever, and productive cough	Diagnosis	Application
91	Upper abdominal pain and two episodes of hematemesis	Diagnosis	Knowledge

Q#	Complaints	Domain	Cognitive Level
92	6 episodes of loose stool with bright red blood	Diagnosis	Knowledge
93	Generalized abdominal pain, multiple bloody stools	Therapy	Application
94	Multiple bright red bloody stools	Therapy	Application
95	4 episodes of bright red bloody stools	Diagnosis	Knowledge
96	Upper abdominal pain and two episodes of hematemesis	Therapy	Application
97	Multiple episodes of hematemesis	Therapy	Application
98	1 day of epigastric abdominal pain and several episodes of hematemesis	Pathogenesis	Comprehension
99	1 episode of hematemesis 3 hours ago	Therapy	Application
100	1 week of black-colored stools and generalized fatigue	Therapy	Application

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